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RUBBER AGE

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Petroleum Products for Rubber

By FRITZ S. ROSTLER and MORAN B. PARDEW

Golden Bear Oil Co., Oildale, California

THIS paper represents an attempt to discuss in a concise form all the underlying principles and major operations in the manufacture of petroleum products which may be of interest to the rubber compounder. A review of the history of petroleum products in rubber is also presented since it might be of general interest, in addition to contributing to a better understanding of present-day uses of petroleum products in rubber.

The term, petroleum products, as used here, does not mean all products which can be made from petroleum since this would include practically the whole field of organic chemistry. The modern petroleum industry is very complex, and produces a number of products for which petroleum is as immediate a raw material as the famous "salt, lime and coal." Petroleum products, as the term is used here, should be understood to be components of petroleum which occur pre-formed in the crude oil or in petroleum fractions derived from non-destructive distillations.

The greater part of the discussion is devoted to products in the boiling range of lubricating oils and to higher boiling fractions, since these fractions are the principal sources of compounding ingredients for rubber. Asphalts are not outside the given definition since they are naturally-occurring components of some crude oil, even though most of the asphaltic products used by the rubber compounder are the result of special operations altering the original properties of the crude oil fraction from which the asphaltic products used in rubber are made.

Petroleum products are used in considerable quantities by the rubber industry, but very little information as to what these products are and how they are made is available to the rubber compounder without considerable expenditure of time and effort to collect data scattered throughout the literature. In many cases information is not available at all.

Compounding ingredients which originate from petroleum are usually identified by such general terms as oils, petroleum naphtha, or by their trade names. Sometimes the products are also described by their functions or suggested applications, e.g., process oils, extenders, reclaiming oils, etc. To combat this lack of exact definition both the supplier (petroleum manufacturer) and the consumer (rubber manufacturer) are setting up and are requiring stricter specifications for the products which go into rubber. These specifications are usually in terms of data from conventional tests designed and used as expressions of functions in applications other than rubber. One purpose of this paper is to explain the meaning of these specifications and their background as well as their significance on the basis of today's knowledge.

The chemistry of petroleum, especially of the higher molecular weight fractions, is at its beginning and is admittedly very rudimentary at present. A discussion of the present status of knowledge will, however, not only be helpful to the rubber compounder, but will further a better and adequate application of petroleum products in rubber. The rubber technologist is often faced with the task of choosing a petroleum product for a particular application from hundreds of products offered under various trade names and described in terms taken from the unfamiliar field of petroleum chemistry. This paper intends to give a description of the background of petroleum products for rubber and to present an over-all picture of their origin, manufacture, composition, and inherent properties.

History of Petroleum Products for Rubber

The use of petroleum products in rubber is as old as the commercial manufacture of rubber goods. One of

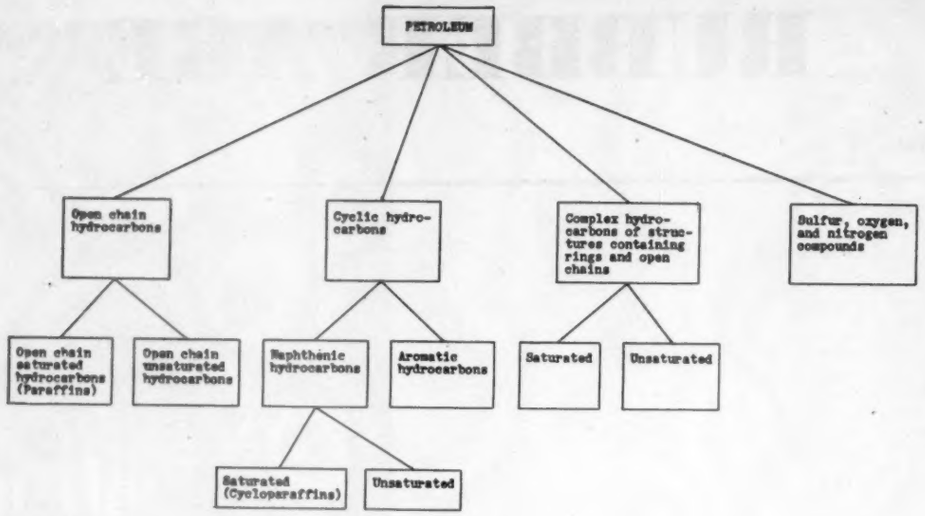

FIG. 1—Chemical classification of petroleum components.

the earliest projects of rubber technologists was the search for a suitable solvent for rubber to replace turpentine, ether and benzene, which were the first solvents used. With the manufacture of rubber goods progressing towards long-lasting products and less hazardous and more economical methods, solvents of petroleum origin entered the field. Petroleum products as compounding ingredients also entered the field at the earliest beginning of rubber technology. Asphalts, the forerunner of today's mineral rubber, and other petroleum products soon found entrance into the rubber industry. Mineral oil was used as a plasticizer, and paraffin as an anti-sun-checking agent.

Relatively new is the use of the unsaturated components of petroleum for rubber purposes. The low molecular weight unsaturated hydrocarbons are valuable monomers in the production of synthetic rubbers. Their uses, as well as chemical composition, are well known and are described in the literature. The higher boiling unsaturated components of petroleum are used as compounding ingredients and are known as plasticizer-extenders. As with all higher boiling petroleum products, very little is known and published about their chemical composition.

The earliest reference to the manufacture of these products is an Austrian patent filed in 1932 *(1)*. These first unsaturated hydrocarbon extenders are known as Naftolens. The first production of these products in the United States on a pilot plant scale was carried out by Wilmington Chemical Corporation in 1938 *(2)*. The earliest English reference to the production of these products is a British patent filed in 1933 *(3)*. The first United States reference is a U. S. patent filed in 1937 *(4)*.

The first reference to the use of the high boiling unsaturated components of petroleum in rubber giving a number of rubber compounds is an Austrian patent filed in 1935 *(5)*, and two booklets, both titled "Naftolen," published by Naftolen-Gesellschaft, Vienna, in 1936 and 1937, respectively *(6, 7)*. The usefulness of the higher molecular weight unsaturated components of petroleum for rubber purposes was at that time already well understood. Three of the compounds suggested in the Austrian booklets are reprinted here as a matter of interest and for comparison with present-day compounding practices. The compounds follow:

RUBBER SOLES

Smoked sheets	34.53
Vulkacit Mercapto (Mercaptobenzothiazole)	—.42
Vulkacit D. (Diphenylguanidine)	—.11
Naftolen 550	8.70
Sulfur	1.50
Channel black	50.10
Zinc oxide	4.64
	100.—
Cured	20′ @ 57#
Tensile strength (psi)	2600
Elongation (%)	215
Schopper hardness	20.—
(Equivalent to Shore hardness of	84)

HARD RUBBER

Smoked sheets	54.4
Vulkacit CT (Crotonaldehyde-aniline condensation product)	.6
Naftolen 550	20.
Sulfur	22.4
Magnesium oxide	1.6
Zinc oxide	1.
Cured	60′ @ 57#
Tensile strength (psi)	8580

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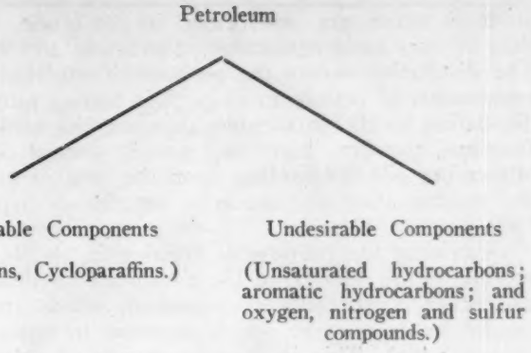
Duprene (Neoprene E)	59.8
Magnesium oxide	6.
Rosin	3.
Naftolen 550	24.
Phenyl-beta-naphthylamine	1.2
Zinc oxide	6.
Cured	54′ @ 57#
Tensile strength (psi.)	1500
Elongation (%)	1075
Schopper hardness	190
(Equivalent to Shore hardness of	25)

The Naftolens were used quite extensively here and abroad. A number of British publications dealt with their application as extenders during the war *(8, 9, 10)*. It is interesting to note that they were used in Germany during World War II in ways very similar to those used here, but to a much greater extent. As can be seen from the various reports published by the Rubber Bureau, W.P.B., and Office of Rubber Reserve, R.F.C.,

TABLE I—CLASSIFICATION OF PETROLEUM PRODUCTS BY BOILING RANGE

Product	*Boiling Range*
Petroleum ether	20°- 60°C.
Gasoline	40°-200°C.
Kerosene	190°-300°C.
Gas oil	200°-350°C.
Neutral oils	270°-380°C.
Light lubricating oils	300°-400°C.
Medium lubricating oils	200°-285°C./10 mm. Hg.
Heavy lubricating oils	285°-330°C./10 mm. Hg.
Asphalt	Residue



Naftolens were used in almost every compound in Germany during the war, either as such or in mixtures with other plasticizers. One interesting use was as a solvent for the Buna S tackifier, Koresin *(11)*.

Shortly after the outbreak of the war, a number of competitive products appeared on the market. To mention just some of the most advertised products, the following trade names are in use for products of this type. On the European Continent are the Austrian Naftolen R100, the German Naftolen ZD, the German Imbutol, the Polish Naftolen R, the British Iranolins, Hibads, and Ravolens (during the war these products were also known and distributed by the British Petroleum Board as "Pool Aromatic Extracts"). Products on the American market are, for instance, Naftolen R100 and Naftolen MV, Dutrex, Coray, and Indonex. One of the latest products is Califlux, produced by Golden Bear Oil Co. The difference in these products is partly due to different raw materials.

Composition of Petroleum

Petroleum is a naturally-occurring mixture of hydrocarbons containing small amounts of sulfur, oxygen and nitrogen compounds. As to the individual hydrocarbons which make up the mixture, practically all hydrocarbons known to organic chemists have been found, or are believed to have been identified, in petroleum fractions. Employing the general classification of hydrocarbons used in organic chemistry one may state that all petroleum consists of paraffinic, cycloparaffinic (naphthenic), and aromatic hydrocarbons, and complex hydrocarbons with the characteristics of two or more of the preceding classifications. Terpenes and polynuclear hydrocarbons with long side chains belong in this last group. In addition to these main components and small amounts of sulfur, oxygen and nitrogen compounds, there are present unsaturated hydrocarbons which can be placed as sub-groups to the main groups which represent the basic structures. This somewhat simplified classification is shown in Figure 1.

A further condensed classification of petroleum components, from the viewpoint of a refiner, is to say that all crude petroleum consists principally of saturated hydrocarbons of the paraffinic and cycloparaffinic groups and of certain impurities, which are: unsaturated hydrocarbons, aromatic hydrocarbons, and a very small amount of oxygen, nitrogen and sulfur compounds. (The last are especially undesirable since they are the cause of bad odor and corrosive combustion products). This classification applies best to the higher boiling fractions, where the unsaturated components are the gum-forming impurities of lubricating oils. Unsaturated and aromatic hydrocarbons are not undesirable in gasoline since they have anti-knock properties.

Petroleum products on the market are, with very few exceptions, described not as to chemical composition but as to their applications and physical characteristics. (The important chemical characteristic, as far as practical application is concerned, is whether they are stable or unstable). The primary physical characteristic used to define petroleum products is the boiling range. A classification of liquid petroleum of California crude oil, characterized by boiling range, is, for instance, that shown in Table I. Another way of classifying petroleum components is by gravity, which may be, for instance, that shown in Table II.

The chemical grouping and classification of petroleum products as given in Figure 1 has nothing in common with such physical classifications, and it can easily be seen that products of the same label can be entirely different, chemically. This difference in chemical composition is of subordinate importance for the primary uses of petroleum, namely, as fuels and lubricants, as long as certain physical requirements regarding heat value, viscosity, and similar characteristics are duplicated.

The picture changes completely, however, when it comes to the applications of petroleum products in rubber. For uses in compounding rubber the chemical composition of the material is of primary importance and influences the properties of the compound; physical properties are of importance only as they influence ease or safety in handling. This difference in grouping and classifying of petroleum products physically and chemically has to be kept in mind by the rubber compounder.

Refining Operations

The purpose of the refining operation is to make petroleum components marketable. The crude oil, as delivered by the wells, is not suitable for any of the uses of modern industry, and has to undergo a number of treatments before the products are in marketable condition. Briefly summarized, the production of petroleum

TABLE II—CLASSIFICATION OF PETROLEUM PRODUCTS BY GRAVITY

Product	*Specific Gravity*	*°A.P.I. Gravity*
Light gasoline	0.700-0.720	70.6-70.1
Gasoline	0.720-0.815	70.1-42.1
Kerosene	0.815-0.855	42.1-34.0
Gas oil	0.855-0.900	34.0-25.7
Light lubricating oil	0.900-0.930	25.7-20.6
Medium lubricating oil	0.930-0.959	20.6-16.0
Heavy lubricating oil	0.959-0.969	16.0-14.5

products which are pre-formed in the crude oil consists of two main operations, distillation and refining. The distillation serves the purpose of segregating the components of petroleum as to their boiling range. The distillation yields, in varying amounts, the well-known fractions, gasoline, kerosene, gas oil, neutral oils, and lubricating oils. Depending upon the type of crude oil the residue after distillation is paraffin or asphalt or both.

Describing the purpose of refining in simple words, refining is the removal of the unsaturated hydrocarbons and other constituents of petroleum which are detrimental to its uses or which decrease its sales appeal (color, odor). This is done by means of solvent extraction with any of several selective solvents, by treatment with sulfuric acid, neutralizing with sodium hydroxide, by dry treatment with clay, or by a combination of these treatments.

It is interesting to note, and it is not without significance, that the same basic methods of refining are applicable, and are applied, to all crude oils. The difference in treatments of oils from various fields consists more in severeness of treatment than in type of treatment. Sometimes one or another step can be omitted, or combined with other steps, if some of the components of the petroleum to be refined are present in the oil only in negligible amounts. Petroleum products which are classified as waste products or by-products as far as the refining operation is concerned are the most interesting raw materials as far as the manufacture of compounding ingredients for rubber is concerned.

Other Operations in Petroleum Refineries

Catalytic cracking, alkylation, and isomerization are processes aimed at splitting the larger molecules, putting the fragments together, and rearranging them for the purpose of increasing the yield of low boiling fuels. These processes should not be considered as actual refining operations in the sense of purifying pre-formed components. These processes deal, furthermore, with the low boiling end products from petroleum and do not enter the picture of rubber compounding ingredients, which are of the higher boiling range.

Classification of Crude Oils

Petroleum differs considerably in composition from well to well. The differences are both as to boiling range and chemical composition. According to boiling range, or rather specific gravity, crude oil is classified as light, medium, or heavy. According to chemical composition crude oil is usually referred to according to its predominant components, as paraffinic or naphthenic, or according to its geographical location, of which its predominant components are typical.

Pennsylvania oil is a typical paraffinic base crude oil, California oil, a typical naphthenic base crude oil, and mid-continent oil, a mixed base crude oil. Consequently, Pennsylvania oil is, to a certain extent, synonymous with paraffinic base crude, California oil, with naphthenic base crude, and mid-continent oil, with mixed base crude. (Borneo oil has a substantial amount—30%—of aromatic hydrocarbons, and is sometimes classified as aromatic base crude oil). California crude oil is also often called asphaltic because of its distillation residue, which is asphalt. The principal distillation residue of Pennsylvania crude oil is paraffin, which is another reason why Pennsylvania crude oil is labeled paraffinic.

* Suggested recently for correlation of swelling behavior with structure.

Numerical Characterization of Crude Oils

Various methods are in use by the petroleum industry to characterize crude oils numerically. These methods, although very useful to the refiner and consumer of petroleum raffinates, are not of much use to the rubber compounder who deals mostly with the unsaturated "impurities," which, as a rule, give values completely outside the range of the arbitrarily selected scales. Some of these characteristics, however, appear from time to time in specifications or come up in discussions and are, therefore, mentioned here.

One method (Bureau of Mines) uses the specific gravity of two "key fractions" as characteristics *(12)*. This method consists of distilling the oil to be classified and measuring the specific gravity of the fraction boiling between 250° and 275°C. at atmospheric pressure (Key Fraction No. 1) and of the fraction boiling between 275° and 300°C. at 40 mm. Hg. (Key Fraction No. 2).

Key Fraction No. 1 is	paraffinic,	mixed base or	naphthenic
if the A.P.I. Gravity is	>40°	33.1-39.9°	<33°
(Specific Gravity)	(<0.825)	(0.826-0.859)	(>0.860)
Key Fraction No. 2 is	paraffinic,	mixed base or	naphthenic
if the A.P.I. Gravity is	>30°	20.1-29.9°	<20.0°
(Specific Gravity)	(<0.876)	(0.877-0.933)	(>0.934)

Another method of classifying oil is by viscosity index (V.I.) *(13)*. This index was originally designed as a numerical expression for the viscosity-temperature variation, and is important for lubricating oil classifications. Since the rate of change of viscosity with temperature is greatest for naphthenic base oils and smallest for paraffinic base oils, the viscosity index is used as an expression of "paraffinicity" or "naphthenicity." The scale runs from 0 for a naphthenic oil to 100 for a paraffinic oil. (Petroleum products used as compounding ingredients have a calculated viscosity index far outside the scale).

Viscosity-gravity constant (v.g.c.) is another value aimed at expressing numerically the terms, paraffinic and naphthenic *(14)*. The viscosity-gravity constant value is based on the fact that Pennsylvania oil (paraffinic oil) has a lower specific gravity than a naphthenic oil of the same viscosity. The viscosity-gravity constant scale runs from about 0.800 for a typical paraffinic oil to 0.900 for a typical naphthenic oil.

Definitions of these indices and constants and their significance for petroleum products are given in detail in every textbook of petroleum; to discuss them here appears unnecessary.

Other numerical expressions which are not based on arbitrary scales are also used to characterize petroleum hydrocarbons. They are either measured physical characteristics or values based on them. The two most-used characteristics of this type are the refractive index and the aniline point. As with specific gravity, these values are very useful to distinguish between products of the same boiling range.

To correct for the influence of boiling range (or, more exactly, molecular weight) values have been designed to be expressions of the structure of the hydrocarbons. Such values are the refractivity intercept *(15, 16, 17)* and values such as ΔM.A.P.* and Δn_D* *(18, 19)*. Refractivity intercept is a value based on the refractive index and is used to identify hydrocarbons as to their homologous series. The refractivity intercept is calculated by the formula,

$$\text{Refractivity intercept} = n - \frac{d}{2}$$

TABLE III—PHYSICAL CONSTANTS MEASURED ON SAMPLES OF HYDROCARBONS AND CALCULATED VALUES FOR STRUCTURE INDICES

Hydrocarbon	Specific Gravity	Refractive Index n_D^{25}	Mixed Aniline Point M.A.P.	Refractivity Intercept* $n - \frac{d}{2}$	Δ M.A.P.	Δ n_D
n—Hexane	0.660	1.3756	68.5	1.046	— 1.0**	0.0025**
n—Hexene	0.673	1.3880	42.3	1.052	—27.0	0.0099
Cyclohexane	0.770	1.4230	49.0	1.038	—20.5	0.0499
Cyclohexene	0.800	1.4449	26.0	1.045	—43.5	0.0718
Benzene	0.878	1.4999	11.2	1.061	—58.5	0.1268
Process Oil 1	0.922	1.506	63.7	1.044	—25.3	0.064
Process Oil 2	0.980	1.557	32.3	1.067	—55.7	0.116

* These values check pretty well with those published in the literature. The following values, for instance, are quoted in Gruse & Stevens *(21)*:

Paraffins	1.0461
Saturated monocyclics	1.0400
Olefines	1.0521
Cycloolefines	1.0461
Aromatics	1.0627

** Theoretically these values should be 0.0000. The deviation is due to impurities in the sample used in the test.

wherein "n" is the refractive index and "d" is the density. The value, △M.A.P., is the difference between the mixed aniline point† of the hydrocarbon in question and the mixed aniline point of a straight chain saturated hydrocarbon with the same number of carbon atoms. The value, $\triangle n_D$, is the difference between the refractive index of the hydrocarbon in question and the refractive index of a straight chain saturated hydrocarbon with the same number of carbon atoms.

It would be outside the scope of this paper to discuss the application of these and similar values in detail. The data in Table III, for five known hydrocarbons and two commercial process oils, may serve as an indication of the significance of these values.

The figures for the known hydrocarbons shown in Table III line up very well with the basic structures. This good correlation invites one to jump to conclusions such as that a petroleum hydrocarbon mixture having a $\triangle n_D$ and a △M.A.P. similar to benzene consists of aromatic hydrocarbons. It should be borne in mind that although this type of values is useful to define petroleum products numerically, the values do not identify chemical groups since there are a number of other facts, such as the additivity of the double bond, which do not allow the principles pertaining to simple and well-defined hydrocarbons to be applied to mixtures of hydrocarbons of complex structures. Process Oil 2 in Table III is most probably not a mixture of aromatic hydrocarbons, as might be concluded from the figures in the table, but a mixture of complex unsaturated naphthenic hydrocarbons with a number of double bonds.

Differences in Crude Oils

It is safe to say that every crude oil contains some of the products belonging in each of the chemical groups given in Figure 1, and that the difference in composition of the oils consists principally in the percentages of the various groups. The chemical type of a crude oil is given by the group of hydrocarbons predominating, as mentioned before. Another important difference in crude oils is their composition as to boiling range.

The California crude is, for manufacturing rubber compounding ingredients, by far the best type since it contains the highest amount of unsaturated and naphthenic (cyclic) components, which makes for the best compatibility with rubbers, synthetic as well as natural. As far as boiling range of a crude oil is concerned, a heavy crude oil is, for the manufacture of rubber compounding ingredients, preferable to a crude oil containing high amounts of low boiling components, which are important for the manufacture of fuels. To summarize, a heavy naphthenic crude oil appears to be the best raw material for the manufacture of compounding ingredients for rubber, in quality as well as in quantity of yield.

† M.A.P. (mixed aniline point) is the aniline point of a 50:50 mixture of the hydrocarbon with normal heptane *(20)*.

Petroleum as Source for Rubber Compounding Ingredients

The unsaturated components of petroleum interesting to the rubber compounder appear in the refinery in three places: in the crude oil or its fractions (crude distillates and distillation residues); in the acid sludges from refining lubricating oils with sulfuric acid; and in solvent extracts from lubricating oil refining with selective solvents. These products, as well as the raffinates, are briefly discussed in the following sections.

Distillates: The distillates are fractions from the distillation of petroleum before refining. They are distilled in arbitrarily selected boiling ranges to satisfy the uses for which they are designed. In accordance with the boiling range, petroleum of any base crude can be, and is, distilled into gasoline, kerosene, etc. The chemical composition of the fractions varies, depending upon the type of crude oil, which is either paraffinic, naphthenic, or mixed base. The percentage of unsaturated components also varies from oil to oil and from well to well. Some of the Pennsylvania oils contain only a very small amount of unsaturates while some of the California oils may contain more unsaturates than saturates.

Raffinates: The raffinates are, roughly speaking, the fractions of petroleum from which the unsaturated components have been removed in the refining process. From the viewpoint of the petroleum industry they are the end product toward which the refinery operations are directed. The raffinates are, as a rule, undesirable as rubber compounding ingredients except where limited compatibility is required, such as for mold lubricants and anti-sun-checking agents.

Acid Sludges: The acid sludges are the precipitates obtained in the refining of petroleum fractions with sulfuric acid. Their composition varies depending upon

the amount and concentration of acid used and the temperature and length of treatment. The amount and concentration of acid used in the refining of oil depends on the degree of refining desired, and varies from a few per cent of concentrated sulfuric acid to thirty per cent, and more, of oleum (fuming sulfuric acid containing free SO_3), the most severe treatment being applied to oils to be used as medicinal white oils, which are 100% saturated hydrocarbons. The sludges from the more severe treatments with fuming acid are rather useless as far as the recovery of hydrocarbon material is concerned since they are water soluble sulfonation products containing a high percentage of free acid and free carbon.

The most useful acid sludges for the recovery of the unsaturated hydrocarbons are the acid sludges from the refining of the lower grade industrial lubricating oils, which are treated for the purpose of removing only the most reactive components of the distillates. These acid sludges are consequently the richest in unsaturated components desirable for rubber purposes. Acid sludges from lubricating oil refining are addition products of sulfuric acid and the unsaturated components of the oil, from which the latter can be recovered.

Solvent Extracts: Solvent extracts, also sometimes called the resinous fractions of petroleum, are the components of petroleum removed from the distillate by means of selective solvents. A number of solvents are used in the petroleum industry. The most widely used and best known ones are furfural, phenol and liquid SO_2. The solvent extracts are, chemically, mixtures of hydrocarbons containing varying amounts of paraffins, cycloparaffins, and unsaturated hydrocarbons of complex chemical composition, which has, so far, been very little elucidated.

As with acid sludges, the composition of extracts depends on the conditions under which the solvent treatment is carried out. The solvent extract contains the unsaturated components as such and not in the form of derivatives as do the sludges. The difference in composition between the extracts and the hydrocarbons recovered from acid sludges is that the extracts include less reactive components, as well as the highly reactive unsaturates which react with sulfuric acid. The varying amounts of saturates which are dissolved in the extract cannot be removed by washing or settling as from sludges.

In other words, for the purpose of producing high grade lubricating oils the solvent treatment is more selective than the sulfuric acid treatment, but for the purpose of separating the unsaturated components the acid treatment is more effective.

TABLE IV—COMPARISON OF SPECIFIC GRAVITY AND MIXED ANILINE POINT OF FIVE PETROLEUM PRODUCTS OF THE SAME BOILING RANGE
(210°-320°C./10 mm. Hg.)

Designation	Sp. Gr.	M.A.P.* °C.
Extender A	1.030	27.4
Extender B	1.027	28.1
Extender C	1.019	40.3
Heavy Viscous Process Oil	0.91	72.5
100% Paraffinic Oil (Commercial White Oil)	0.86	83.5

* Mixed aniline point (aniline point of 50:50 mixture of the material with n-heptane).

Asphaltic Components of Petroleum: Asphaltic components of petroleum are concentrated in the distillation residue. The asphaltic components of petroleum are the most complex products of the petroleum industry. The information available in the literature about these products is not very informative and is often contradictory. Difficulties in elucidating the composition of petroleum fractions increase rapidly with molecular weight. The asphaltic components of petroleum are the highest molecular weight components. Opinion even as to the value of their molecular weights varies considerably, from as low as 400 to as high as 150,000 *(22)*.

The petroleum asphalts are, chemically, polymerization, condensation, and other reaction products of petroleum, most probably formed under the influence of oxygen and sulfur. They are usually sold according to two main specifications: softening point and penetration. Their principal uses are as road oils, roofing asphalts, and in fuels.

Products of asphaltic nature are of interest to the rubber compounder in that they represent low cost processing aids and bulking agents in the form of organic fillers. The asphaltic materials most used and best known in the rubber industry are seldom the original components of petroleum obtained as residues from distillation, but are usually further-oxidized products.

Principal Compounding Ingredients for Rubber Originating from Petroleum

Mineral Rubber: The petroleum products used in compounding rubber in largest volume are the asphaltic materials known as mineral rubbers, or hard hydrocarbons. These products are conversion products of this petroleum component produced by oxidation with air at elevated temperatures. The manufacturing methods consist of bubbling air through the asphalt at elevated temperatures for the length of time required to obtain the softening point and penetration specified for mineral rubbers.

Specifications for mineral rubber are usually: solubility in carbon disulfide (required, 99.5 soluble), low ash (0.5), neutral reaction, softening point, and penetration. The significance of the latter two specifications for asphaltic petroleum products has not been clearly established. The following facts should be considered, however, when using asphaltic products as rubber compounding ingredients. The softening point should be high enough to prevent chips, or otherwise reduced particles, of asphalt from fusing together during storage.

Considering this property, a softening point of 110°C., measured by ring and ball method, appears to be sufficient. The penetration gives some information as to the plasticity and milling properties of an asphaltic product of a softening point higher than milling temperatures. This correlation of properties is at present under investigation in our laboratory, but from preliminary tests it can be stated that the penetration, measured according to A.S.T.M. Designation D5-25 *(23)*, should be in the neighborhood of about 25 at 70°C. under a load of 100 grams.

The importance of solubility in carbon disulfide, low ash, and freedom from acids lies in the fact that components insoluble in carbon disulfide are usually gritty impurities, and that electrolytes, revealed by ash, and acids interfere with acceleration and electrical properties.

Extenders: The next products, as far as volume consumption by the rubber industry is concerned, are the so-called unsaturated hydrocarbon extenders or co-

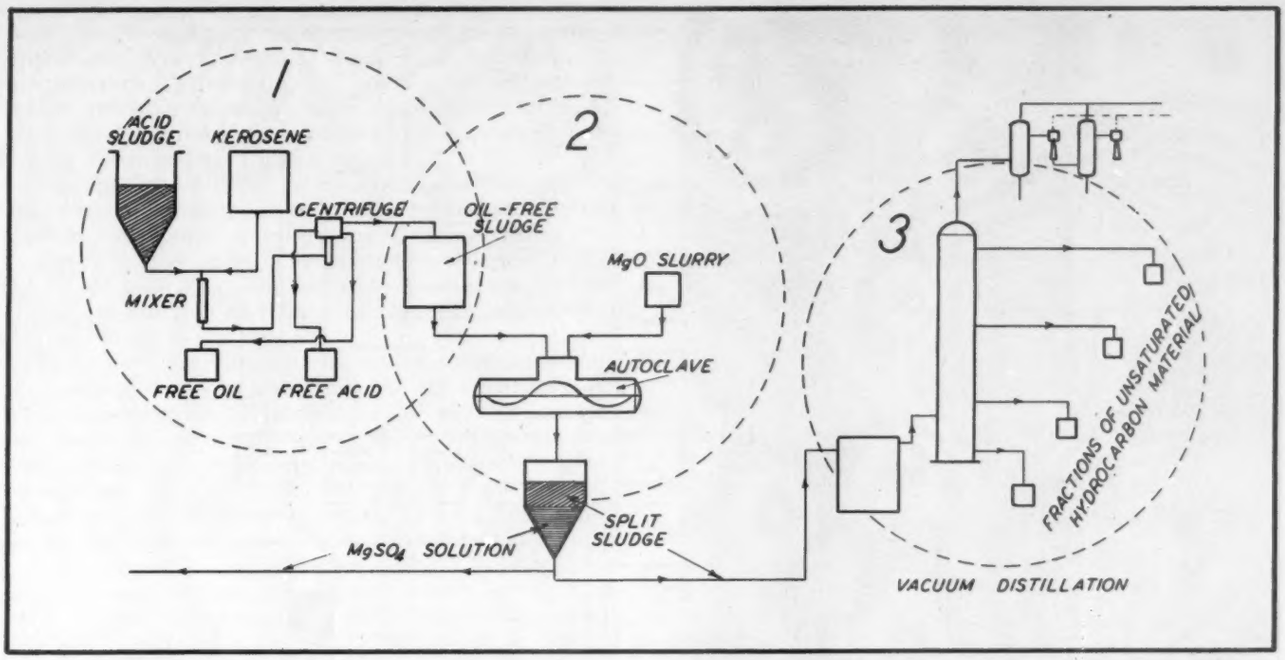


FIG. 2—Manufacturing process for production of unsaturated hydrocarbon extender from acid sludge. (1) Removing of free acid and emulsified saturated hydrocarbon oils from sludge by mixing with kerosene and centrifuging in a three-way centrifuge. (2) Splitting of the acid sludge (addition product of sulfuric acid and unsaturated hydrocarbons) by treating with magnesium oxide slurry and separating the "split sludge" and magnesium sulfate solution by settling. (3) Vacuum distillation of split sludge.

vulcanizable plasticizers. The best known representatives are the Naftolens. This type of product is produced either from acid sludge or from solvent extract. The production of serviceable extenders is more or less elaborate, but, judging from numerous tests carried out in our laboratory on samples of such products on the market, common practice ranges from filling labeled drums with refinery waste products to chemical treatments of selected crude oils combined with careful fractional distillations and blending operations. A number of methods of production of unsaturated hydrocarbon extenders have been patented *(24, 25, 26, 27, 28)*. One of these methods of producing the unsaturated hydrocarbon extenders from acid sludges, a modification of the original Naftolen method (U. S. Patent No. 2,185,951) *(24)*, is depicted in the flow sheet given in Figure 2.

The production of the unsaturated hydrocarbon extenders from extracts is simpler than from acid sludges since the step of splitting-off and removing the acid is eliminated.

Unsaturated hydrocarbon extenders are sold to the rubber industry under various trade names, sometimes with, sometimes without, specifications. If specifications are given, they are, as a rule, the following physical characteristics: specific gravity, aniline point, refractive index, boiling range, flash and fire point, iodine number, viscosity.

Few of the specifications indicated have any great significance, but all together they might indicate variations in shipments. Specific gravity, aniline point, and refractive index are indications of the percentage of unsaturated components in the extender. Higher percentage of unsaturated components, in two products of the same boiling range, is indicated by higher specific gravity, higher refractive index, and lower aniline point. All three characteristics are influenced by molecular weight and boiling range, and a comparison of two products of different boiling ranges is consequently meaningless. Measured on products of the same boiling range, specific gravity and mixed aniline point are quite characteristic as has been shown in Table III. The data given in Table IV, measured on five commercial products of the same boiling range, show that specific gravity and aniline point, or the mixed aniline point as given in the table, run parallel, in that products with higher specific gravity have lower aniline point.

The aniline point should be low, in fact too low to be measured as straight aniline point. For instance, a good plasticizer-extender with a 50% boiling point of about 300°C. at 10 mm. Hg. should have a mixed aniline point* below 40°C. Extenders for oil-resistant rubbers should have still lower mixed aniline point, preferably below 25°C. The importance of low aniline point is emphasized because it can be stated generally that a high percentage of unsaturated components is, for rubber compounding purposes, desirable, and that the saturated components, especially those of the paraffinic type (revealed by high aniline point), should be classed as impurities which interfere with the compatibility of the extenders with rubber and will cause blooming when used with oil-resistant rubbers *(29, 30)*.

Boiling range requirements can be briefly summarized in the statement that no compounding ingredient used in rubber should contain any components boiling below vulcanization temperatures or temperatures to which the finished product will be exposed. As a rule of thumb, products with an initial boiling point below 250°C. are not safe to use in rubber compounds.

Flash and fire point are two rather meaningless specifications, not only for rubber compounding ingredients, but also for petroleum products in this boiling range in general *(31)*. The values are always high enough to place the products outside the group of fire hazards, but tell nothing as to the percentage of low

* Aniline point of 50:50 mixture of the material with n-heptane *(20)*

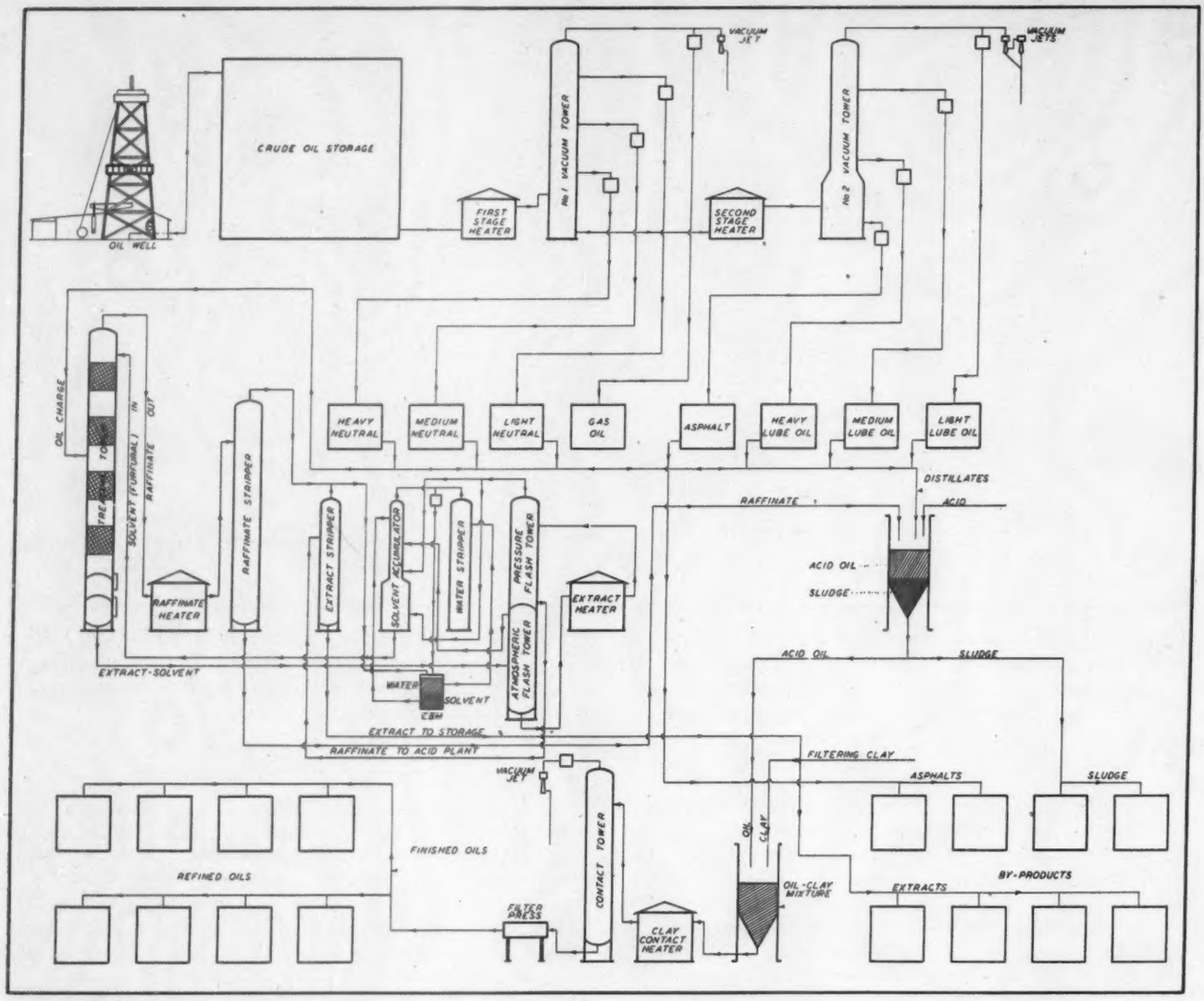


FIG. 3—Flow chart of principal operations of the Golden Bear refinery.

boiling components for which the flash and fire points are also supposed to be an indication. Since these compounding ingredients are as a rule solvent extracts, the flash point can be greatly influenced by traces of solvent left in the product. If, for instance, SO_2 was used as a solvent, traces of this fire-extinguishing gas would raise the flash point, contradicting and falsifying the interpretation.

The iodine number should be low, between 40 and 100, measured according to Hübl *(32)*. A combination of low iodine number and high specific gravity is an indication of a high concentration of unsaturated components, which in themselves are not so highly unsaturated as to create a great sulfur deficiency and poor aging characteristics in a compound. Too high unsaturation of the extender will also tend to make the compound susceptible to the influence of oxygen.

The significance of viscosity is quite obvious and does not need much explanation. Viscosity is a measure for free-flowing properties and pumpability of a product. There is, however, one significant point in connection with this group of petroleum products which might be worth mentioning; that is, that for unsaturated components of petroleum the temperature-viscosity curve is very steep, and the difference of a few degrees in temperature will change the viscosity tremendously. This great sensitivity of viscosity to temperature is characteristic of the unsaturated components produced from acid sludges and solvent extracts and is not to be found in the saturated components of petroleum. In the case of high-grade lubricating oils, for instance, it is important that viscosity change little with temperature variation.

For the sake of completeness, we mention that another group of plasticizer-extenders are to be found on the market; they are solutions of asphaltic products in crude distillate-type products. Some of these are especially prepared by air-blowing the petroleum distillates. These products are low-viscosity oils, black in color, containing a considerable amount of saturated hydrocarbons.

Process Oils: Process oils represent another group of compounding ingredients which consist of petroleum components occurring pre-formed in crude oil. They differ chemically from extenders in that they contain considerable proportions of saturated hydrocarbons or of unsaturated hydrocarbons less reactive than those to be found in the extenders. Products of this type can

have their origin at a number of steps in the refining operations. Very little has been disclosed about the manufacturing of this type of product, but all products which are offered on the market are blends of saturated and unsaturated hydrocarbons of the viscosity and boiling range of light lubricating oils.

The specifications for process oils again are physical characteristics such as color, aniline point, boiling point, flash and fire point, specific gravity, and viscosity.

The color should be light and stable. A good process oil should keep its color practically indefinitely in closed containers and for at least a number of months when exposed to air and sunlight.

As to the significance of the other specifications for process oils, it can be stated that the aniline point is the most important one. It should be low since it is, of all the specifications usually given, the only indication of compatibility with rubber hydrocarbons, especially of the oil-resistant type *(30)*. A low aniline point indicates a low proportion of the saturated hydrocarbons which are incompatible with oil-resistant rubbers.

Boiling point is also important and has to be watched since process oils are taken from lower boiling fractions of petroleum than the unsaturated hydrocarbon extenders described above. An initial minimum boiling point of 250°C. seems to be indicated as a minimum requirement. A combination of low aniline point and high initial boiling point is a valuable indication of the usefulness of a process oil in compounds for high temperature applications, since this combination is an indication of properties which make for retention of the process oil in the vulcanized compounds during service.

Flash and fire point are without significance for the same reasons given previously for extender-type products.

Specific gravity should be high since that is indicative of a high percentage of unsaturated and naphthenic hydrocarbons, which are compatible with rubber to a higher degree than the paraffinic, which are to be considered impurities in this type of product. A specific gravity of higher than 0.95 appears to be a reasonable minimum requirement.

The viscosity of process oils should be low enough to insure free-flowing properties under normal atmospheric conditions.

Reclaiming Oils: Reclaiming oils of the unsaturated hydrocarbon extender-type are relatively new *(33)*. They are of much lower viscosity than the extenders. Their principal characteristic is that they have equal swelling action on GR-S and natural rubber. In contrast to the solvent naphtha-type reclaiming oils, which are removed from the reclaim during the reclaiming process, the extender-type reclaiming oils are of sufficiently high boiling range to remain in the reclaim as permanent plasticizers. Reclaiming oils of this type are actually plasticizers which are incorporated into the reclaim during its manufacture. Their function is not only to swell the ground scrap before and during the reclaiming, but also to aid in the refining of the reclaim. As permanent plasticizers they give the reclaim softness and tack.

A good reclaiming oil of this type can also be used as a low viscous plasticizer in compounds requiring not more than about ten or fifteen parts of plasticizer on one hundred rubber. The following characteristics have been measured on a reclaiming oil of the extender type:

Boiling range	100°-250°C./10mm.Hg
Viscosity	11 cP at 60°C.
Mixed aniline point	27°C. (ΔM.A.P.—60.5)
Refractive index (n_D^{25})	1.550 (Δn_D 0.109)
Specific gravity	0.98

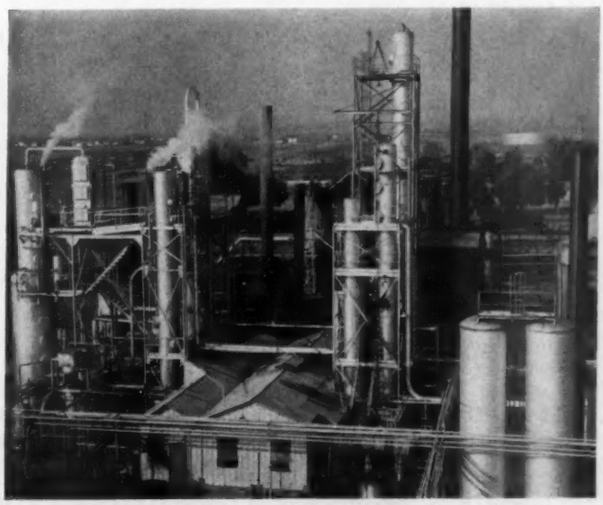


FIG. 4—Vacuum distillation unit (left) and furfural extraction plant (right).

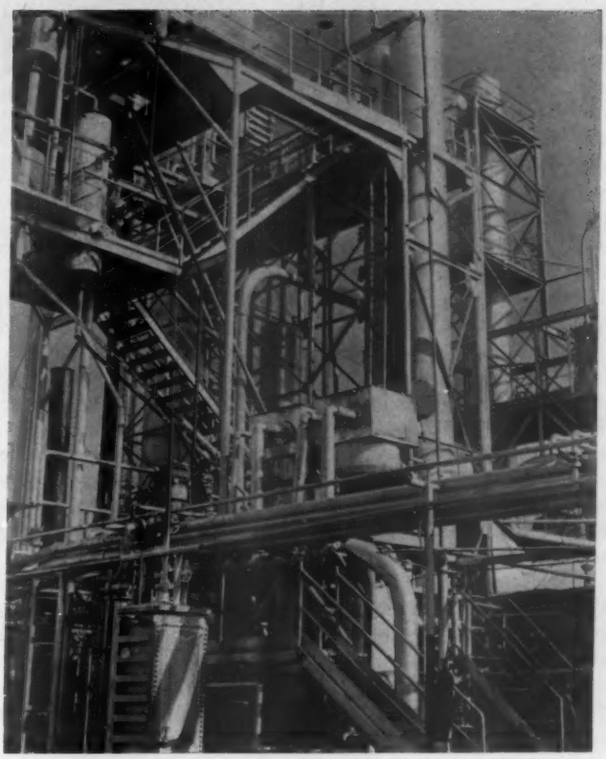


FIG. 5—Section of vacuum distillation unit at the Golden Bear refinery.

Petroleum Refinery Operations

The foregoing discussion, although not including all petroleum products used in rubber compounding, touched on the most important ones and will give a general orientation, showing how much, or rather, how little, is known about the products in question. To complete the picture an example is given of a refinery and its operations.

Figure 3 is a flow chart illustrating the principal re-

fining operations at a petroleum refinery operating on heavy crude oil. Crude oil from the oil-wells is pumped into the refinery through pipe-lines. The principal equipment of the refinery shown is a vacuum distillation unit of a capacity of 2500 barrels per day, a solvent extraction plant operating with furfural, an acid treating plant, and a clay contact plant.

The first step of the processing is a two-stage vacuum distillation. The equipment consists of two pipe stills and two fractionating towers. The first tower operates under a vacuum of 200 mm Hg and delivers four fractions of distillates, which are: gas oil distillate, light spray oil distillate, heavy spray oil distillate, and light lubricating oil distillate. The higher boiling, unfractionated parts (bottoms) go through a second heater or pipe still and into the second fractionating tower. The second stage of the distillation is a combined vacuum-superheated steam distillation effecting fractionations which are equivalent to distillation under laboratory conditions under 1 mm Hg. The fractions obtained from the second stage distillation are: medium and heavy lubricating oils and asphalt.

The fractions obtained from the vacuum distillations are extracted with furfural and/or treated with sulfuric acid. The treated oils are neutralized and contacted with absorptive clay.

The refinery shown in the flow chart does not produce gasoline and does not operate any cracking or conversion units. It is designed for refining operations in the sense of separating and purifying the components existing pre-formed in crude oil. Using a heavy California crude oil, the refining operation yields about equal parts of treated oils and by-products in the form of extracts and sludges.

Figures 4 and 5 are recent photographs, which give a general impression of the scale of the equipment in a moderate-size, modern refinery.

Outlook

Since petroleum, and even more, the by-products from its refining, are the cheapest raw materials available in substantial quantities for the manufacture of rubber chemicals of hydrocarbon nature, it is safe to predict that petroleum products will be used in increasing amounts by the rubber industry. It has been said that the widespread use of petroleum products as extenders during the rubber shortage will decrease and perhaps disappear. The authors do not share this view, but do think that development work is required to bring out the advantages of the products in question, or to modify the products. The indiscriminate use of extenders as bulking agents for rubber compounds is, with few exceptions, definitely over. This change is to be welcomed, however, because it will bring about intensified efforts to put these petroleum products to use where they are of real advantage.

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Engineering with Adhesives

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IN A DISCUSSION of the type we should like to present, we probably should define just what we mean by the term adhesive. According to the dictionary, an adhesive is "a substance that causes adhesion, tending or causing to adhere." Perhaps a little closer examination of this definition will help us in some of the problems we have in "Engineering With Adhesives." In the first place, adhesives are never used by themselves, they are always used to hold other materials together. This tends to complicate the problem of testing and using adhesives because you always have to consider not only the adhesive itself but also the materials which are being adhered. We shall refer to this fact later in the discussion.

General Factors to Be Considered

Since adhesives are always used in conjunction with other materials a number of forces come into play. First, the forces which hold the adhesive to the materials being bonded; secondly, the forces which hold the adhesive together. In other words, we have both adhesion and cohesion to contend with. The theory of adhesion has been discussed by a number of authors—Rinker and Kline, Weyl and others—and we shall not discuss it here.

Since an adhesive is always used with other materials, it is important that the structure being used shall be designed correctly since the design of a part on which an adhesive is being used can make the use successful or cause a failure. This is due to the fact that adhesives are used with rigid materials and also with flexible materials. Since this is so, one can get stresses which range from pure tensile to those which are pure shear. It is also possible to obtain almost any combination of these stresses.

Adhesives are often used to adhere materials with very different coefficients of expansion. Again, design of the part can be most helpful in minimizing the stresses caused by the expansion and contraction due to changes in temperature. Much can also be done to help through the choice of the correct adhesive in all cases. Some adhesives will be better from the standpoint of shear. When the adhesive is good in shear it is obvious that the part should be designed to put the largest part of the stress in shear to take advantage of its good shear strength.

Since adhesives are used to hold materials together and since the types of materials to be bonded range from very soft paper to metals, it is obvious that there is no universal adhesive. If for no other reason than cost we would not use the same adhesive for paper to paper and metal to metal. The same degree of strength is not required in each case and it is conceivable that the properties of an adhesive could be too good to make for successful usage when cost is considered.

Adhesives are used in many places where the conditions of use vary from very hot to very cold. It is rather easy to formulate an adhesive for any set condition but not so easy to make one which will do well under all conditions. Therefore, it is necessary to give consideration to conditions of use and many times it will be necessary to compromise and make use of the adhesive which most nearly fulfills the most important conditions the structure must withstand. If only cold is encountered, an adhesive can be designed to give a good account of itself. If both high heat resistance and good cold resistance are required a compromise will no doubt have to be made in which some heat resistance and also some cold resistance will have to be sacrificed.

We should probably also consider the kinds of adhesives available and should indicate the relative importance of the adhesive industry. Adhesives go back to ancient times and considering the materials which they used, the ancients did a good job. It is rather difficult to evaluate the tonnage or get a picture of the dollar volume because the adhesive industry is usually included with another industry. Adhesives made the boxboard industry possible yet since the finished product is the one which we analyze, the amount of adhesive used is hidden. Plywood is another example, as are the many uses of adhesives in the rubber industry.

Types and Forms of Adhesives

Roughly we can divide adhesives into these arbitrary classes:

Starch Pastes and Gums
Animal or Fish Glues—Vegetable Protein Adhesives
Natural Resin Adhesives
Inorganic Adhesives
Thermoplastic and Thermosetting Resins
Rubber and Synthetic Rubber

It should be kept in mind that combinations of the various groups can be made. This then gives us a new set of variables to fit into all of the materials which we may attempt to adhere. This indicates to some degree the complexity of the job of using adhesives intelligently.

We feel that more adhesives are constantly being used in industry. This is no doubt due to the fact that we are constantly striving to accomplish end results with the minimum of effort and at the lowest possible cost. Adhesives are being used in more and more places since the new raw materials available have made possible adhesives with rather unusual properties. Since many of them have high strength or unusual resistance to solvents, adhesives can be considered for jobs which a few years ago were considered to be impossible.

Adhesives are available to the customer in various forms:

Water dispersed adhesives
Solvent dispersed adhesives
Adhesive film on carriers
Unsupported film adhesives

The latex compounds and emulsions of adhesives and pastes are good examples of the water dispersed adhesives. Nearly everyone is familiar with the solvent dispersed adhesives. Tapes, both the activated and pressure sensitive types, are also activated by use of heat and pressure. The unsupported film adhesives are best activated by the use of heat and pressure.

Methods of Application

After having talked about the many combinations which are possible when one is using adhesives, we should also consider how these adhesives may be applied. The materials which are either in water or solvent can in most cases be brushed, and, of course, this is a simple way to apply material to small areas. Usually where large amounts of adhesive must be applied or if a certain thickness of adhesive should be used, other means of application must be used.

There are a good many ways in which this can be accomplished. Two, however, are very widely used. Where the adhesive is of the proper consistency it may be applied by knife or doctor blade. Many people also apply adhesives from pick up rolls which run in a reservoir of the adhesive. These two methods work very well where flat surfaces are to be adhered.

Many times it is necessary to coat irregular surfaces and in these cases it is possible to get an excellent job by spraying the adhesive. With the introduction of heavy duty pumps it is now possible to spray quite heavy material. Adhesives may also at times be flowed through a hose to the place they are to be used and there be dropped on the material to be adhered. A brush may be added to a setup of this kind and the material may be applied and brushed at the same time. An example of this type of application is on the adhering of weatherstrip rubber to automobile car doors. By means of a flow gun and a brush attached to the gun, the adhesive is flowed in place and brushed out to the right thickness in the same operation. The weatherstrip rubber is then put in place. The door can be closed to press it in place and a good job is obtained.

When the adhesive is used as a tape there are a good many ways of applying. On machine application it may be activated by solvent or water and thus rolled or brushed in place. Where an adhesive is used which has pressure sensitive characteristics the activation is not necessary. Film adhesives unsupported are usually cut to size required then put in place and heat and pressure applied to get the material to set.

It should be emphasized that it is not enough to have the correct adhesive for a job, the adhesive must be used correctly before the best results can be obtained. This can be illustrated rather easily. If an adhesive which is cut in a vehicle is used between surfaces which do not allow the vehicle to escape a very poor job of adhesion will be obtained. If creep is of importance, a thin film of adhesive will do the best job. If a thick film is applied, the job will not be a good one. We cannot emphasize too much the fact that as many adhesive failures are caused by improper use of an adhesive which will do a job as by the use of the wrong adhesive.

Since adhesives are used with other materials it is necessary that these materials shall be in the best condition for using the adhesive. The surfaces to be adhered should be clean since often the adhesive will adhere to the foreign matter on the bonding surface and pull it away. Many surfaces have thin films of oil or other foreign matter which can seriously interfere with adhesion. On metals, in many cases, scales or oxides are present which may interfere with adhesion or if they are not well anchored may be pulled away by the adhesive.

There are a number of ways to clean the surfaces. Many times it is possible to clean by giving the surface a light scuffing with coated abrasive paper or a wire brush. It is also possible to vapor or sand blast the surface in order to assure that it is clean. In some cases the surface can be cleaned by use of a solvent. It is necessary to use care in selection of the cleaning solvent since an oily type may deposit a film which will in itself interfere with the adhesion. Another method used is to etch the surface of metals by the use of proper reagents. These must then be removed and the surface must be dried before the adhesive is used. Since an adhesive must wet the surface on which it is to be used, it can be seen that a clean surface is very essential.

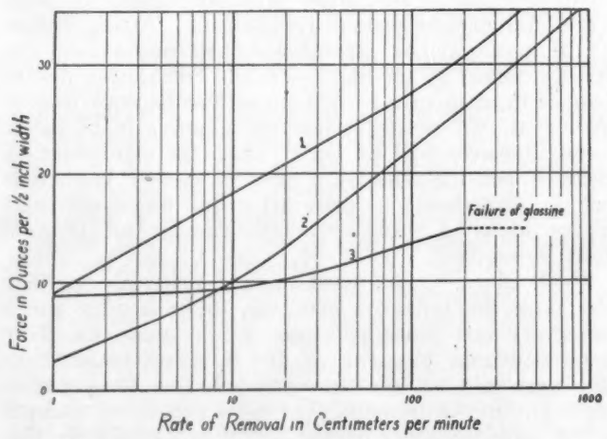
In some cases it is possible to get an adhesive which in itself cleans the surface to be adhered. This is sometimes true when water dispersed adhesives are used on surfaces which have a film of oil or when using a solvent adhesive which will dissolve the film which may be present. It is a safe rule, however, to use a clean surface to obtain the best results in using an adhesive.

Progress in Testing Methods

The testing of adhesives is important since we cannot any longer afford to get our results by trial and error. Much work has been done on testing of adhesives by individual companies and the methods used are those which most nearly answered their individual needs. In fact, in a good many cases, the development man in adhesives found it necessary to first devise a test which would show that his work was carrying him in the right direction.

This challenge has been accepted and it is our feeling that real progress is being made in the various committees of A.S.T.M. and especially Committee D-14 on Adhesives. Their work has progressed to the place where methods are being written and published. Many companies and individuals are also making valuable contributions.

We previously mentioned that it was possible to have pure tensile or pure shear and nearly any combination of the two in application stresses to adhesive bonds. This has made the problem of strength tests a difficult



Adhesion of "Scotch" brand transparent tape to (1) cellulose acetate, (2) cellophane, and (3) glassine after one week of contact (Stripping angle, 90°; temperature, 25° C.; relative humidity, 50%).

one. The design of specimens is important since if they are not correctly designed we may get combinations of stresses which will be difficult to separate in analyzing the results. We should also like to point out that on adhesives which have a tendency to cold flow or creep, it is not enough to measure the strength by means of a tensile testing machine but it is also necessary to test under static load conditions. This is necessary since an adhesive with high values when pulled apart at a rate of say two inches per minute may fail when left under much lower constant stress.

We should like to include the results of some testing we have done. The values reported are the results of adhering "Scotch" brand adhesive tape to various surfaces. The values are given in ounces per ½ inch width after twenty-four hours contact. The rate of stripping is 100 cm per minute; stripping angle, 90°; temperature, 25° C.; R. H., 50%.

Cellophane (600 14½% glycerin)	21
Cellulose Acetate (2 mil commercial film)	25
Nitro cellulose (commercial film)	13*
Vinyl chloride—vinyl acetate copolymer (commercial film, unplasticized)	23
Polystyrene (coated on paper, unplasticized)	17*
Paper (Permanized Artesian Ledger)	17*
Glassine	12*
Steel	19*
Chromium plate	24
Nickel plate	18
Silver plate	20
Brass plate	18
Aluminum	19
Glass	25
Automotive enamel	25
Automotive lacquer	25

* Increasing.

In the accompanying graph, we have plotted force in ounces per one-half inch in width against the rate of removal in centimeters per minute for "Scotch" brand transparent tape on cellulose acetate, cellophane and glassine.

These results show that a given adhesive gives different results when stripped from different surfaces. We can also see that the maximum value of adhesion is not reached in twenty-four hours of contact.

Observation of the graph shows that the rate of removal has a marked influence on the values and that the change with rate of removal is different for different surfaces. At low rate of removal, cellulose acetate and glassine are nearly equal. At higher rates of removal the value on cellulose acetate increases rapidly while the value on glassine increases but little. At low rates cellophane has a very low value but it increases rapidly to quite a high value.

These results seem to indicate that it is difficult to predict how an adhesive will behave under any set of conditions. In recommending the use of an adhesive it is almost necessary to test against the type of surface and as nearly under use conditions as possible. In other words, it is not possible to recommend an adhesive for all types of vinyl films simply because it works on one type of vinyl film. This is usually due to the wide variation in the compounding of the vinyl type of film.

The standardization of test methods should accelerate the writing of specifications. Most manufacturers of adhesives are now issuing standards under which they make their materials and it is our feeling that this fact has encouraged many people to use adhesive since they have convinced themselves that adhesives now can be purchased meeting definite specifications. As we make further progress in standard test methods it will become easier to write specifications for adhesives.

Growth of the Industry

We mentioned that it is difficult to get a good picture of the amounts of adhesives being used. We know, however, that the adhesive industry is growing larger. More companies are engaged in making adhesives and the variety of materials available is growing. This does not mean that the older types of adhesives are being replaced. It is our feeling that the volume of business for these concerns has increased and the new business has been largely due to new adhesives which have answered problems which a short time ago were not considered as capable of being done with adhesives.

One of the reasons of the increased use of adhesives is that they allow the engineer to accomplish many jobs with a minimum of labor and as a consequence at the lowest possible cost. The new adhesives have increased the field for adhesives by making possible many constructions which would not be possible with conventional type fasteners. Adhesives will only be used if they do a job, at a cost which will make them competitive to other types of fasteners.

In considering the cost of an adhesive, it is necessary to go beyond the cost per gallon. In some cases a material which sells at a low cost may actually be very expensive. The real figure is the one which takes into consideration the total cost per unit of using each adhesive. In other words, an adhesive at 20c per gallon may be expensive if it takes ½ gallon to do a unit if another adhesive at $1.00 per gallon will do twenty units. It is always well also in considering costs to appreciate that waste or defectives must be figured into the cost and that often one adhesive may lend itself to a method of application which will give a lower unit cost than another adhesive.

Some Specific Applications

We have done considerable work with the automotive industry and perhaps could tell you of some of the problems which occur in this industry. With the use of the all metal body it became necessary to cut down on the rumbling noise which occurs when the car is driven over a rough surface. One way of accomplishing this is to adhere a pad into the roof of the car.

The adhesive which best answers this use is one which is low in cost per unit. It must be cut in a non-inflammable vehicle since it is used where welding or drilling of metal is going on. It must have high heat resistance since after a body is finished it may need repairing and will need to stand the oven heats, or it may even be put through the paint ovens in the process. It must not lose adhesion under very humid or wet conditions since it may have to go through the bonderizing process. It must have high strength while wet since the line moves rapidly and the pads must be installed before the adhesive has an opportunity to gain strength. After the material is dry, it must have good shock resistance both at ordinary temperatures and at low temperatures. It must have good life aging properties since it must hold the pad in place during the life of the car.

A water dispersed adhesive of high viscosity seems to answer the needs outlined above since it has high enough wet strength to hold the pad, has no inflammable solvent and gives good shock resistance and life aging. The material can be applied by means of automatic roll coater or by spraying the roof or pad. This is often done in the inverted roof before welding but some prefer to put the pads in the roof after the body is assembled.

Another problem in the automotive plants is the one of adhering weatherstrip rubber to the body. The problem here is one of obtaining good adhesion to lacquer and weatherstrip rubber and to retain the application characteristics needed. A special problem encountered here is the fact that the weatherstrip often contains large amounts of plasticizer which reacts with the adhesive, making it soften and lose strength. This type of adhesive must have good life aging, should be strong and have high heat resistance.

We have also done work with the construction industry and while in the automotive industry everything is on a production line basis and can usually be rigidly controlled, the construction adhesive is used by a mechanic who is on his own. Instead of using mechanical equipment for applications, most of the work is done by using a trowel or brush.

In this type of usage it is very nearly impossible to control the method of use. For this reason it is not practical to use water dispersed adhesives since only small quantities are shipped and it is not possible to protect against freezing. All construction adhesives should be as low cost as possible. They should also be as fool-proof as possible.

Acoustical tile adhesives are used to hold light weight tile to ceilings. The adhesive must be light in color, low in cost and must be high in wet strength. It must at the same time be easy to trowel or handle since it is applied to the tile by means of a trowel. It must have excellent life aging as must any adhesive used in the construction industry.

It is important that the tile used be dimensionally stable since if the tile expands it may force the tile away from the ceiling. If the tile expands on one side while the other does not change it can exert a very large force on the tile and may cause failure. It cannot be stressed too much that the surface to which the tile is adhered should be clean since dust or loose paint or moisture will prevent the adhesive from sticking and will cause a failure.

We should like to mention a few examples of the use of adhesives on unusual applications. There has been considerable publicity on the use of an adhesive for bonding brake lining or blocks to brake shoes. Here an adhesive is replacing rivets and does a better job since it does away with the rivet holes and also makes it possible to use the lining for a longer time. Some of the danger of scoring brake drums is eliminated since the rivet holes which collect debris and the rivets are no longer there to score the drum.

Adhesives are being used to laminate metal skins to light weight cores such as end grain balsa or honeycomb resin impregnated paper, giving structures which are very light and yet very strong. The lamination of metal to wood gives structures which have most of the advantages of both materials. These panels are being used by the transportation industry where they fill a need in giving a decorative panel with good strength.

Adhesives with very high strengths have been developed. On metal to metal bonds, values as high as 4000 p.s.i. have been obtained. These offer design possibilities since they would no doubt allow designers freedom to accomplish things which might not be possible through the use of rivets or other fasteners. One thing will have to be given consideration and that is a good means of testing adhesive bonds without the necessity of ruining the structure. We understand that this is being given consideration.

Conclusion

To conclude, it should be remembered that the use of adhesives is always tied to other materials. The correct use of an adhesive is as important as to use the correct adhesive. Many types are available and many methods of application will solve many problems.

It is the desire of the adhesive industry to help solve the problems of the engineer and the continued development of new adhesives will no doubt make them available for many uses for which adhesives are not adaptable. Cooperation between the adhesive industry and the user will pay dividends to the user in a satisfactory job at the right cost and to the adhesive manufacturer in an expansion of adhesive uses.

Note: This paper was presented at the Chicago Technical Conference held in Chicago, Ill., on March 24, 1948.

The Genius of Industrial Research. By D. H. Killeffer. Published by the Reinhold Publishing Corp., 330 West 42nd St., New York 18, N. Y. 6 x 9 in. 270 pp. $4.50.

Intended to guide the young research worker and others ambitious to undertake research, this book describes modern industrial research and its methods. The material is largely from the field of industrial chemistry, for in no other is research so important, so well developed, and so fruitful. The accounts of how many important modern developments were achieved are quoted directly from original presentations—a method adopted by the author to give a clear insight into the reasoning behind these researches. The point of view throughout the book is that of the individual research worker and not that of management or direction.

Described at some length in the book are the research methods which produced high-octane gasoline, celluloid, rubber accelerators, modern refrigerants, and the gas-filled tungsten-filament electric lamp. As an example of an investigation developing over a long period of time and through the work of a number of successive persons and groups, the author has chosen the synthesis of rubber. The evolution of synthetic rubber is traced in a chapter of 24 pages (Chapter 9), with liberal passages reproduced from the reports of Sir William Tilden, Wallace A. Carothers, Waldo Semon, and others. The work of George Oenslager on the development of organic accelerators is also given some detail.

Indonex Plasticizers in Mechanical Goods Compounds for High Temperature Curing. (Circular No. 13-2-1). Chemical Products Department, Standard Oil Co. (Indiana), 910 So. Michigan Ave., Chicago 80, Ill. 8½ x 11 in. 6 pp.

As indicated by the title, this technical report indicates the advantages to be gained by using Indonex plasticizers in good quality and medium quality mechanical goods compounds where high temperature curing is employed. Average physical data for all cures of these compounds at all temperatures, before and after oven aging, are given. The summary indicates that as far as original properties are concerned it appears that the use of Indonex in the proportions indicated has little effect on the relation between physical properties and curing temperature. Comparison of the data after oven aging leads to this same conclusion. On the other hand, comparison of the original and aged properties for a given accelerator-sulfur combination at a given curing temperature shows the generally beneficial effect of the plasticizer on aging characteristics of such compounds.

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The Master of Flame. Ansul Chemical Co., Fire Extinguisher Division, Marinette, Wisc. 8½ x 11 in. 20 pp.

Charts showing the characteristics of approved hand fire extinguishers and the comparative effectiveness of approved extinguishers on flammable liquid fires are features of this catalog. The catalog illustrates and describes the complete line of fire extinguishers produced by the company.

Electronic Tension Control in Golf Ball Winding

By K. E. WILHELM, K. J. RUPPRECHT and F. S. MARTIN

United States Rubber Co., Providence, R. I.

THE use of electronic tension control has brought a degree of precision to the winding of golf balls that was undreamed of relatively few years ago. The first golf balls from rubber thread were made by Haskell about 1899. They were produced by hand winding rubber thread on a center and then molding a cover on the resulting core. In the ensuing fifty years or so, winding machines were developed and improved so that the thread could be laid down in the core in a definite reproducible pattern.

The highly skilled golfer demands a great deal of a golf ball. He wants very hard balls to obtain maximum distance and he obviously wants all the balls he uses to have the same flight characteristics. It was easily demonstrated that the important performance characteristics of a golf ball depended in a large measure on the hardness of the ball and that the hardness was a function of the unit tension applied to the rubber thread during winding. The modern golf ball winding machine was a tremendous advance over the early machines and hand winding methods. However, in order to produce balls showing the uniformity desired, it was necessary to use some sort of tension control in winding the balls.

The early tension devices which were largely adaptations of textile thread tensioning mechanisms were not very satisfactory for use with rubber thread. The mechanical tension devices were improved to the point where it was possible to reproduce the tension setting as desired and to observe, on a scale, the tension being applied to the thread at any instant during winding. A further advance added a mechanical control mechanism to keep the total tension on the thread relatively constant. However, it is practically impossible to obtain rubber thread with absolutely uniform size (cross sectional area) and cure (modulus). For these reasons the unit tension on the thread will be variable when control is based on the total tension applied to the thread. Therefore, it is the unit tension rather than the total tension which must be controlled to obtain the desired uniformity along with optimum playing qualities in the finished golf ball.

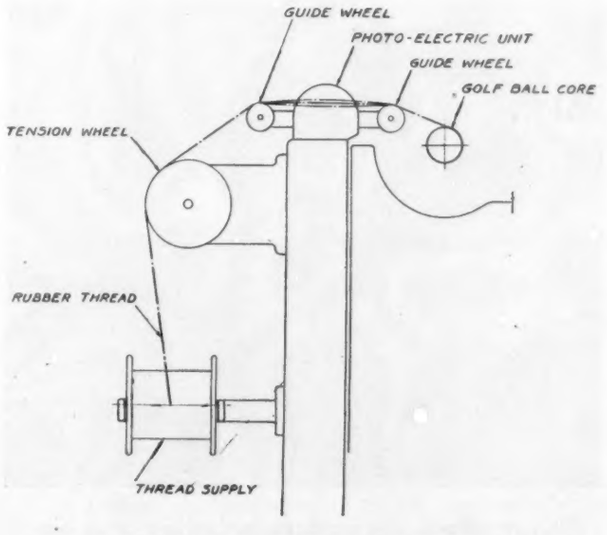


FIG. 1—Mechanical linkage in outline form.

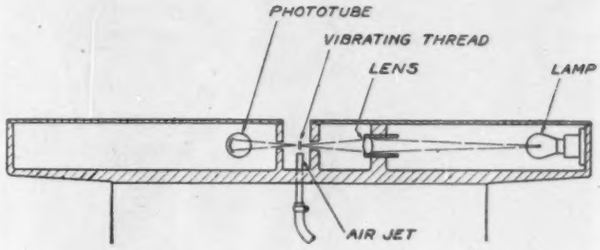


FIG. 2—Photo-electric unit.

In order to overcome the inherent shortcomings of the mechanical tension device, an electronic means of control was developed (U. S. Pat. No. 2,425,909) based on the principle of keeping the unit tension in the thread constant. The electronic tension device described below responds very rapidly and takes care of thread size, and modulus variations in a way that is quite beyond the capabilities of the earlier mechanical tension devices.

Fortunately, a physical relationship existed which could be used as a basis for this device. This relationship may be derived from the well-known formula for the natural frequency of a vibrating string:

$$f = k \frac{1}{L} \sqrt{\frac{T}{M}} \qquad (A)$$

where

f = frequency (cycles per second)
k = a constant
L = length of vibrating string
T = tension (total)
M = linear density

but

M = Ad = Mass per unit length

where

A = cross-sectional area of thread
d = volume density

Substituting in the formula above, we get:

$$f = k \frac{1}{L} \sqrt{\frac{T}{Ad}} \quad \text{or} \quad f = k \frac{1}{L} \sqrt{\frac{S}{d}} \qquad (B)$$

where

S = unit tension (stress)

FIG. 3—Easy and convenient servicing is a feature of the tension device. Here a serviceman is replacing one of the electronic units.

In the case of the rubber thread used for winding golf balls the volume density "d" stays quite constant and "L" may be kept at a fixed value. Consequently, we arrive at the conclusion that the natural frequency is proportional to the square root of the unit tension applied to the thread as shown by formula (C):

$$f = K\sqrt{S} \qquad (C)$$

Thus, by controlling the natural frequency of vibration of the thread, we can control the unit tension on the thread. This means that if we can keep the frequency of vibration of the stretched thread at a fixed value we will, in fact, be keeping the unit tension at a corresponding fixed value. This will be true regardless of variations in thread size or modulus.

The tension device developed to operate on this principle consists of three component parts; namely, a mechanism for applying and adjusting the tension on the thread, a device for translating the mechanical motion of the vibrating thread into an electric signal, and finally, an electronic unit which detects variations in frequency and actuates the tension adjusting mechanism. These units were designed to work together so that stability of control would be combined with a high degree of sensitivity. A very important feature of the design is that reasonable day to day variations within the mechanical system have practically no influence on the performance of the device as a whole. This is due to the fact that the electronic circuit merely impresses power, in addition to that already existing in the mechanical system, until the total power provides the proper tension.

Fig. 1 shows the mechanical linkage in outline form. On top of this is mounted the vibration pickup device. The rubber thread is passed from the supply spool around the tension wheel which is the only exposed part of the mechanical linkage. From the tension wheel the thread in passing on to the golf ball core being wound is led over two free running guide pulleys. The segment of the thread between the guide pulleys may be kept in constant vibration at the natural frequency of the thread by any one of several means. Fig. 2 illustrates the use of an air jet for this purpose.

A photoelectric unit (Fig. 2) translates the mechanical motion of the thread into an electric signal of a corresponding frequency. This device consists of a lamp with a straight filament, a lens for focusing an image of the filament on the rest position of the thread, and a phototube that picks up the light from the light source. The light beam is interrupted when the vibrating thread passes through its position of rest. As this happens twice during each vibration cycle of the thread, an electric signal of twice the frequency of the vibrating thread is generated by the phototube. The phototube device is but one of several effective vibration pickup methods that have been worked out. However, a necessary requirement for all of them is that they shall not be affected by the noise and vibration of the winding machine.

The signal from the phototube is amplified and fed into a frequency discriminator circuit. This circuit makes use of the phase shift across a parallel resonant circuit, which is set for resonance at a frequency corresponding to the desired unit winding tension. The output of the discriminator circuit is fed into a power amplifier that actuates a solenoid motor which in turn adjusts the thread tensioning mechanism. The action is such that when the frequency of the signal from the phototube is equal to the frequency for which the resonant circuit is set, no readjustment of the thread tensioning mechanism takes place. If, at any instant, these frequencies are different, readjustment takes place until the unit tension on the thread is again at the desired value.

The circuits are designed to react only to changes in frequency. Changes in signal amplitude, voltage, tube characteristics and the like may slightly affect the speed of the control but will not change the control point. The speed of control is adjusted to provide for fast readjustment while still avoiding instability. Thus, the lag in reaction to changes such as variations in thread size or modulus is kept to a minimum. The sensitivity of the device is such that readjustment takes place for variations in unit tension of less than one percent of the desired unit tension. For practical purposes, this sensitivity is more than adequate.

FIG. 4—Bank of modern winding machines equipped with electronic control units.

From the beginning, it was obvious that for large scale factory use it would be necessary to make provisions for easy and convenient servicing of the tension device. This was the reason for dividing the device into the three separate units mentioned previously. Any one or combination of these units may be removed from the winding machine and replaced with a minimum of machine down time. For example, Fig. 3 shows a serviceman replacing one of the electronic units. With this arrangement, it is possible for winding to proceed with very little interruption while a unit is taken out of service for repair or calibration.

The final design as shown provided a visual indicator permitting the operator or serviceman to observe the operation of the mechanism during winding. The resonant circuit which controls the frequency is housed in a separate box (see Fig. 3) provided with a large dial to permit rapid and accurate setting of the winding tension.

Fig. 4 is a photograph of a bank of modern winding machines equipped with electronic control units. These machines have been giving excellent results in factory operation for some time now.

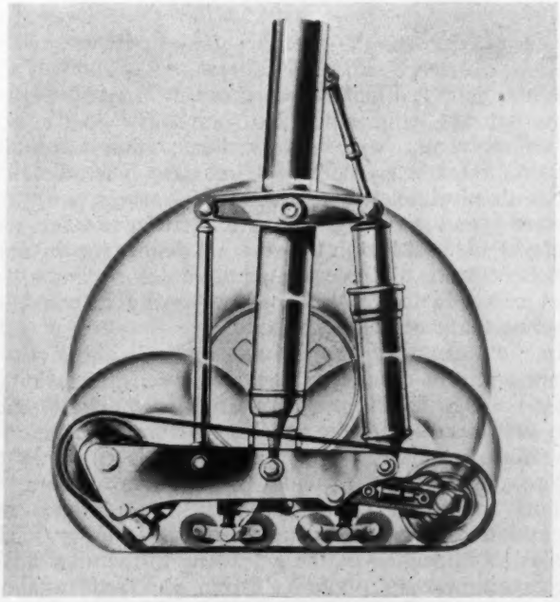
Track-Type Landing Gears for Large Transport Airplanes

TRACK-TYPE landing gears—which General George C. Kenney claims would have saved six months in the island-hopping air offensive against Japan—now are receiving serious consideration by most aircraft companies building large transport airplanes.

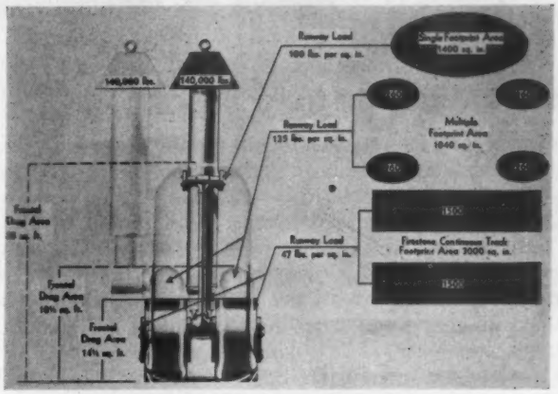
Proved experimentally during the war on a PT-26, P-40 and A-20C, the endless rubber belt type of landing gear, nicknamed "flying runways," will permit large transport craft to land and take off at sod and dirt airstrips. A development of the Firestone Tire and Rubber Company, this new type landing gear may replace conventional wheels and tires on most large aircraft.

Advantages of the track-type landing gear are:

1. Ability to operate from sand, dirt and sod, sinking less than one-third as much as tires.
2. Ability for heaviest planes to operate from existing runways because load is spread over approximately 250 per cent greater runway surface.
3. Eliminates "bounce" from hot landings; the gear holds to the ground after touch-down.
4. Virtual elimination of ground-loop dangers.
5. Reduction of maintenance by eliminating possibility of blow-outs and punctures; also less vulnerable to gun fire than tires.
6. Compactness enables retraction into smaller wing or nacelle well.
7. Greater stability when striking ground obstacles.
8. More efficient braking through larger ground contact area; better cooling of brakes through better heat dissipation.
9. Belt runs cooler than a tire so wears less; also low unit ground pressure of belt upon landing allows sufficient slippage at first contact to practically eliminate wear as a life factor.



The volume displacement of single tire, multiple tire and Firestone continuous tracks is portrayed graphically in this phantom drawing.



Comparative data on frontal drag area, runway load pressure and footprint area of single tire, multiple tire and Firestone continuous tracks are illustrated above as they would operate on aircraft of the 140 ton class.

Currently, an installation of a track-type landing gear is being test-flown on a Fairchild C-82 for further Air Force experimentation. With this new gear, military utility of the transport will be greatly enhanced. Virtually every large open field becomes an operational air strip for cargo or troop-carrying purposes.

Commercially, the new landing gear would open up hundreds of small communities to air cargo service. These communities generally would not be able to finance runway construction for establishment of today's type of airport facilities.

During the war, the Air Forces authorized experimental development of a track-type landing gear. The gear was developed by Firestone as an endless belt of rubber reinforced with wire cord plies and grooved to fit into V-shaped bogey rollers. Flight tests of the landing gear on the Douglas A-20C proved the gear practical on concrete runways, sod, mud, soft dirt and dune sand.

The Photo-Oxidation of Olefins

By L. BATEMAN

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RATHER than deal solely with the somewhat specialized subject of the title, the purpose of this lecture will be better served perhaps if first I recall the several changes in rubber induced by or associated with exposure to light, proceed briefly to review the causative factors, referring particularly to photo-oxidation, and then indicate how a detailed study of the mechanism of photo-oxidation is extending our understanding of olefinic oxidation generally.

Exposure Cracking and Sun Crazing

Two separate physical changes can be observed during the deterioration of vulcanized rubber surfaces following atmospheric exposure. One, now termed exposure cracking, is characterized by the development of cracks at right angles to the direction of strain. The other, known as sun crazing, consists of a certain resinification of the surface with the formation of an irregular pattern of very fine cracks reminiscent of an aged paint film.

Considerable confusion has existed both as regards the recognition of these two effects and the nature of their causes, as evidenced, for example, by the frequent but erroneous designation of the former as "sun cracking." However, a recent paper *(1)* by Dr. R. G. Newton of the R.A.B.R.M., which critically examines earlier work as well as presenting some pertinent experimental results, does much to dispel the confusion by convincingly correlating exposure cracking with ozone attack, and sun crazing with surface oxidation promoted particularly by the shorter wavelength components of sunlight. The following are some interesting features of these processes:

(1) Although chemical attack of ozone would be expected to be substantially indifferent to the physical state of the rubber, raw or vulcanized, stretched or unstretched, solid or in solution, crack development is peculiarly sensitive to the degree of tension of a vulcanized specimen. Cracking is negligible when the rubber is under no strain, becomes maximal at *ca.* 20% extension, and then decreases quite sharply again.

Newton has shown, however, that ozone absorption does occur at first to a small extent with unstretched rubber to produce a microscopically thin, but nevertheless an extremely efficient, protective film which seals the rubber substrate against further reaction. Under tension this film breaks down and ozone attack as measured by the rate of *formation* of microscopic cracks steadily increases to a maximum at about 80% extension. Newton explains the greatly enhanced crack *growth* at the lower extension as arising from increased coalescence of small cracks, this phenomenon reflecting the response of the particular geometry of the cracks to the prevailing strains.

(2) The formation of cracks under the optimum strain conditions is so sensitive a test for ozone that it can be used as a rough measure of the variations in atmospheric ozone concentration (which is of the order of 0-10 parts per 100 million) occasioned by meteorological and geographical conditions. For example, cracking increases during cyclonic depressions which favor the transfer of ozone from the upper atmosphere, and becomes much less in industrial areas where smoke and acid fumes remove ozone by chemical reaction.

(3) Protective action against cracking consists in extending the experience with unstretched rubber described above, i.e., producing a protective surface film. This is commonly done industrially by incorporating waxes such as Okerin and Heliozone, but chemical modification of the surface layer is also effective. Of special interest is the protection afforded by oxidation. If not too extensive, sun crazing protects considerably against ozone cracking, and corroboratively factors conducive to the former reduce the latter.

In opposition to the view that exposure cracking is promoted by light, irradiation generally inhibits crack formation, and this is particularly so in the case of white rubber articles which, as is well-known, are much less resistant to sunlight aging than dark vulcanizates. The dark pigment or a filler such as carbon black absorbs nearly all the incident radiation and thereby minimizes the photo-activation of the rubber and its oxidation products which, anticipating later discussion, is responsible for oxidation photo-catalysis.

Experiments establish that the presence of carbon black markedly increases the susceptibility to exposure cracking, whereas the inhibitory action of white fillers persists until the oxidative crazing produces surface faults which allow ozone penetration to the interior of the sample.

Photo-Gelling

When rubber dissolved in so-called "active" solvents (e.g., ketones, chlorinated hydrocarbons) or in "non-active" solvents (e.g., hydrocarbons, ethers) containing sensitizers (e.g., aldehydes, ketones) is irradiated by visible or ultraviolet light without free access to oxygen, it undergoes a mild type of vulcanization and the solution gels *(2)*. Although the reaction details for the many systems empirically investigated are unknown and are almost certainly too complex to be readily resolved, the common features are clear enough.

In the absence of oxygen, free radicals photolytically produced from the active solvents or sensitizers initiate cross-linking. In the presence of oxygen, photo-oxidation first ensues with the usual molecular degradation of the rubber chains; when the oxygen is used up the oxygenated groups provide photo-active centers for radical formation with consequent cross-linking. Readmission of oxygen during the irradiation invariably causes solubilization of the gel owing to the unavoidable accompaniment to photo-oxidation referred to above. As expected, substances (e.g., anti-oxidants) which react with and destroy free radicals delay gelling, their action being more marked in systems involving oxygenated free radicals.

One of the most interesting queries is whether pure rubber hydrocarbon undergoes gelling in the complete absence of oxygen or any other potential cross-linking agency. A study of the photolysis of highly purified rubber in a high vacuum *(3)* reveals that it can. On irradiating this system with ultra-violet light, decomposition occurs with concomitant cross-linking, but the reaction is so inefficient that any alternative cross-linking mechanism provided by the presence of oxygenated groups will in practice always predominate.

Further Aspects of Rubber Oxidation

As the foregoing references tend to suggest, oxidation and its associated changes are mixed blessings to the rubber technologist. There is, for instance, the decidedly odd situation that the deleterious effects of aging and one of the most important processing operations, viz., milling, are both largely controlled by these reactions. An understanding of the detailed chemistry of these reactions is therefore a matter of fundamental industrial importance. The rest of this lecture will be devoted to a description of work having this ultimate objective and originating mainly from a B.R.P.R.A. team at Welwyn.

Cursory examination soon shows that the oxidation of rubber, and especially vulcanized rubber, is far too complex a reaction to admit of direct attack. This is partly because even in the early stages of the reaction the product appears to be heterogeneous and the physical nature of the material hampers analysis and identification, and partly because of the added complication arising from the attendant molecular cleavage. Accordingly, it is necessary to elucidate the reaction mechanism in more straightforward examples first, and then extend the investigations as knowledge grows.

Simple olefins such as cyclohexene and the 1:4-diene ethyl linoleate, $CH_3(CH_2)_4CH = CH\text{-}CH_2\text{-}CH = CH(CH_2)_7\ CO_2C_2H_5$, absorb several units per cent of oxygen at moderate temperatures to yield almost quantitatively an ethylenic hydroperoxide *(4)*. The over-all reaction may be written

$$RH + O_2 \rightarrow RO_2H$$

where RH represents the olefin and R the hydrocarbon fragment left when an α-methylenic hydrogen atom H is detached.

An essential preliminary to a detailed description of the reaction course is thus available, but this product identification can of itself give no information concerning mechanism. Analogy perhaps emphasizes this point best. You know that I have travelled from Welwyn and arrived in Manchester, but on this fact alone the nature of my journey cannot be decided. You can deduce with virtual certainty of course that I did not come by sea, and since my colleagues on similar business travelled by train no great imagination is needed to surmise that I doubtless did likewise. Beyond this point, however, inspiration proceeds by pure guesswork, for I could have travelled by a dozen different routes which only examination of my tickets and hotel bills would differentiate.

Resolution of the detailed course of a chemical process requires an analysis of the reaction kinetics, i.e., an experimental determination of the dependence of reaction rate on the concentrations of the reactants and any catalyst over a range of temperatures. If a reaction scheme can then be devised that satisfies the experimental rate law, it remains to be subjected to as many independent checks as possible to test its validity.

Kinetics of Mono- and 1:4-Di-Olefin Oxidation

Kinetic analysis establishes that both photo and non-photo oxidation proceed by the same basic mechanism. This proves to be a chain reaction, in which an initially formed reactive intermediate produces the stable product by a reaction that concurrently regenerates a similar intermediate, this cyclical process being interrupted when the intermediates, or chain carriers, are otherwise destroyed *(5)*. Chain reactions thus comprise three sequences, known as the Initiation, Propagation, and Termination reactions, which in olefinic oxidation are the following:

Initiation	(1)	Production of R— or RO_2— radicals	r_i
Propagation	(2)	$R— + O_2 \rightarrow RO_2—$	k_2
	(3)	$RO_2— + RH \rightarrow RO_2H + R—$	k_3
Termination	(4)	$2R— \rightarrow$	k_4
	(5)	$R— + RO_2— \rightarrow$ Inactive products	k_5
	(6)	$2RO_2— \rightarrow$	k_6

where R— is the free radical derived from the olefin RH as explained above, RO_2— is the corresponding peroxide free radical, r_i is the rate of the initiation reaction, and the k's are the respective velocity coefficients of the other reactions.

An important feature is that by the nature of the termination reactions the yield of hydroperoxide can never be 100%, but is governed by the average number of times the propagation cycle is repeated between destruction of a chain carrier by inter-radical reaction. If this ratio, which is termed the chain length, be 99 say, then the hydroperoxide will be contaminated with 1% of foreign product.

Experiment shows that reactions 4 and 5 are insignificant except at low oxygen pressures (roughly less than 50 mm. Hg.), and that termination normally occurs exclusively via reaction 6. When these conditions prevail, it can be shown by standard methods which need not be elaborated that this oxidation scheme requires the over-all rate to be given by

$$\text{Rate} = r_i^{\frac{1}{2}}\, k_3 k_6^{-\frac{1}{2}}\, [RH] \qquad (1)$$

the square brackets denoting a concentration term.

It follows that if we can initiate the oxidation in different ways then we shall have a series of kinetically distinct but closely related systems, each of which can serve to verify the rate law, and which taken together can do so *a fortiori*. This has been done with completely consistent results *(6)*. Dr. J. L. Bolland has kinetically investigated oxidations initiated by (a) the thermal decomposition of dibenzoyl peroxide (Bz_2O_2); (b) the thermal decomposition of ethyl linoleate hydroperoxide ($R'O_2H$); and (c) direct bimolecular interaction between the olefin and oxygen; and I have similarly investigated initiation by (d) decomposition of an olefin or its hydroperoxide by ultra-violet light.

Independent evidence shows that r_i is respectively

(a) $k_a\, [Bz_2O_2]$;
(b) $k_b\, [R{\cdot}O_2H]^2$;
(c) $k_u\, [RH]\, [O_2]$; and
(d) Φ I,

where ϕ is the primary quantum yield, i.e., the number of radicals produced per quantum of light absorbed, and I is the rate of light absorption. The experimentally observed rates of oxidation are

(a) $k_c\, [Bz_2O_2]^{\frac{1}{2}}\, [RH]$;
(b) $k_a\, [R{\cdot}O_2H]\, [RH]$;
(c) $k_u\, [O_2]^{\frac{1}{2}}\, [RH]^{3/2}$; and
(d) $k_e\, I^{\frac{1}{2}}\, [RH]$

where the k subscripts c, a, u, and l are used to signify catalytic, autocatalytic, uncatalyzed, and photo (light) reactions. These expressions are in each case just the

appropriate modification of equation (1) which theory demands.

We feel confident therefore that the oxidation scheme presented is not only correct but uniquely so. This confidence is strengthened by finding that for a given olefin the temperature coefficient of the ratio $k_3k_6^{-\frac{1}{2}}$, which from the Arrhenius equation $k = Ae^{-E/RT}$ gives the activation energy difference $E_3 - \frac{1}{2}E_6$, is independent of the oxidation system, although the over-all activation energies are widely different owing to different contributions from the varied initiation reactions.

As mentioned earlier, the above analysis refers only to those olefins that yield substantially 100% hydroperoxide in the early stages of oxidation (*cyclo*hexene, methyl*cyclo*hexene, methyl oleate, and ethyl linoleate have been especially investigated). Extension of this work to the polyisoprenes is not yet sufficiently advanced for discussion, but to illustrate the caution that must be exercised in passing from one olefinic system to another it can be reported that while the kinetics are very similar the over-all reaction is not that previously shown, and a rather more complex chain mechanism is operative *(7)*.

Some Special Features of the Photo-Oxidation Kinetics

Certain mechanistic details are revealed more directly by the photo-kinetics because an additional variable to those typical of thermal reactions is available. First the rate dependence on $I^{\frac{1}{2}}$ demands specifically that the termination reaction involves the mutual destruction of two chain carriers, whereas the validity of this from Bolland's work rests on the consistency of the kinetic analysis as a whole. Secondly, since the photo initiation reaction is practically temperature independent, the over-all temperature coefficient measures $E_3 - \frac{1}{2}E_6$ directly, whereas the thermal data yield this quantity as a difference between two much larger quantities.

The nature of the initiation process calls for some comment. The author has studied the photo-reaction at two essentially monochromatic wavelengths of incident radiation, viz., 2537Å and 3650Å, which are regions of high and low olefinic absorption, respectively, under the conditions of experiment.

At 3650Å, the pure olefin starts to oxidize extremely slowly but as reaction proceeds the rate first increases very rapidly and then falls off to a constant maximum value. This rate increase can be correlated quantitatively with the increase in light absorption arising from the formulation of hydroperoxide, which is known to absorb much more strongly than the parent olefin. This clearly suggests that this process

$$RO_2H + h\nu \rightarrow R— \text{ or } RO_2—$$

is the main initiating mechanism.

At 2537Å, only a minor degree of autocatalysis is observed owing to the high initial absorption by the olefin, but since the hydroperoxide will absorb most of the light when the reaction has proceeded to a small extent it must again be the main site of R— or RO_2— production. This inference is supported by estimating the efficiency of the primary process. The chain length, n, the over-all quantum yield, ϕ, and φ are related thus:

$$\varphi = \Phi/n$$

Although accurate comparison is difficult, experiment shows that the value of φ is very much less for an olefin than for its derived hydroperoxide *(3, 8)* (by a factor of the order of 10^3). As ϕ can be measured directly and n assessed from both catalyst and inhibitor efficiencies in the parallel thermal reaction, an indirect estimate of φ is readily obtained. This is found to agree closely with the value determined for the hydroperoxide, whose dominant initiating role cannot therefore be questioned. Nevertheless, the photolysis characteristics, while in agreement with inappreciable initiation by the reaction

$$RH + h\nu \rightarrow R—$$

in the near ultra-violet spectral region, intimate that such a contribution may intrude at shorter wavelengths.

A rather more subtle application of photo methods based on rate changes during intermittent illumination remains to be briefly reviewed. This application is only possible when the reaction rate varies as $I^{\frac{1}{2}}$, and is most easily expressed by a concrete example *(9, 10)*.

Suppose the light is interrupted between the source and the reactants by a rotating sector which equally cuts off the light and lets it through. Then, if the dark period is short compared with the time of the chain cycle, the rate (r_{fast}) will vary as $(\frac{1}{2})^{\frac{1}{2}}$, whereas if the dark period is long compared with the chain time, so that the radicals generated in a light period are destroyed during the succeeding dark period, the rate (r_{slow}) will now vary as $\frac{1}{2}^{\frac{1}{2}}$. The duration of the dark period when the r_{fast}—intensity relationship over the r_{slow}—form clearly measures the average duration of one chain cycle.

Not only is this information of intrinsic value, but its knowledge permits the propagation and termination rate constants to be separately evaluated (the ratio $k_3k_6^{-\frac{1}{2}}$ is only obtained otherwise). This technique has been applied to a number of olefins *(11)*.

The detailed results, actually derived by more rigorous mathematical analysis of the rate relationships than outlined above, are in the course of publication elsewhere and will not be presented here. In generalized form, however, they reveal that for a given rate of initiation comparative oxidizability quantitatively defined by the k_3 values, k_6 being independent within experimental error of the nature of the olefin; and that the chain time is a matter of seconds. The latter seems surprisingly long on first thoughts, but is really in accord with the relatively rather difficult rate determining step (i.e. reaction 3) in the propagation cycle.

ACKNOWLEDGMENT

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Note: One of a series based on lectures delivered during 1947-48 by members of the staff of the British Rubber Producers' Research Association at Newton Heath Technical School, Manchester, England.

Effect of Microorganisms on Rubber Degradation

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BOTH natural and synthetic rubber may deteriorate with time when exposed to certain conditions, e.g., light, moisture, chemicals, and occasionally microorganisms. More data is available on the aging of rubber products than on the resistance of rubber to biological attack. Consequently, this discussion will be limited to a review of the information on the effect of microorganisms on rubber degradation. If one was to inquire of each reader on this question, one would secure quite differences of opinions and answers. In other words, it is a highly controversial subject.

Rubber Not Immune to Attack

In discussing the action of microorganisms on rubber hydrocarbons Zobell *(1)* definitely gives the impression that rubber is not immune to attack and that in some cases the rubber is even decomposed. The assumption that rubber stoppers, tubing, gaskets and so forth, are biologically inert, according to Zobell, has led to anomalous experimental results. There are cases on record showing that rubber will materially increase the biochemical oxygen demand of water samples. The observation was confirmed by Zobell and Grant who noted further that exposure to pure gum rubber or neoprene increased the oxygen consumption by bacteria in the sea water.

The utilization of caoutchouc by *Mycobacterium sp.* was reported more than thirty years ago. From garden soil and canal water several strains of organisms were found which grow well on purified rubber treated with mineral solution. "Spot disease" bacteria found on sheet or crepe rubber cause decomposition of the rubber. Gradual loss in weight and decreased elasticity of moist sheets of plantation crepe rubber have been attributed to the activities of *Penicillium* and *Aspergillus* species.

Spence and Van Niel characterized the decomposition of Hevea latex hydrocarbons as being both rapid and profound after noting the disappearance of 20 per cent of the rubber in purified latex under the influence of soil microflora for six weeks at 20°. Twenty to forty per cent of the rubber from latex dispersed in mineral solution was destroyed in a month at 28° by species of *Actinomyces, Aspergillus oryzae, Penicillium* species and various raw soil cultures. By sprinkling finely divided soil on plates of mineral agar coated with a thin film of rubber Kalinenko showed that rubber oxidizing bacteria are widely distributed in garden soil.

As a general rule pure rubber is oxidized by bacteria more rapidly than compounded or vulcanized rubber products. It was suggested that rubber could be protected with preservatives and that tetramethyl thiuram disulfide (Tuads) rendered rubber resistant to attack by *Macrosporium sarcinaeforme.*

Dimond and Horsfall *(2)* recognize that rubber is decomposed in contact with water. They discussed the use of mercaptobenzothiazole (Captax) and tetramethyl thiuram disulfide (Tuads) as a preservative. Both of these compounds are rubber accelerators. They bring out the fact that Captax is inactivated as a fungicide when the rubber is compounded with zinc oxide, whereas Tuads retains its efficacy and they, therefore, recommend the use of the latter.

Zobell and Grant *(3)* state that neither synthetic nor pure India rubber is biologically inert, and proving that rubber oxidizing microorganisms occur fairly abundantly in nature, they suggest that such microorganisms may play an important role in the deterioration of rubber products.

Zobell and Beckwith *(4)* state, in summary, that rubber hydrocarbon is attacked by a large number of microorganisms, including species of *Actinomyces, Proactinomyces, Micromonospora, Mycobacterium, Aspergillus, Penicillium, Pseudomonas, Bacillus* and other genera. Rubber is decomposed more rapidly by mixed cultures than by pure cultures. Oxygen consumption, carbon dioxide production, the multiplication of microorganisms and loss in weight of the rubber show that the rubber is being attacked by a medium which has no other source of carbon or energy. Microbiological activity also causes rubber to swell. Pure natural rubber is more susceptible to oxidation by microorganisms than compounded rubber products, although many rubber products are attacked. Microbial activity may play an important role in the deterioration of rubber products which are exposed to moisture under conditions favorable for the growth of microorganisms. From experimental data it is estimated that up to ½ pound of rubber hung in the inner lining of a 50-foot length of garden hose may be oxidized in one year if water is left standing in the hose.

Synthetic Rubbers Susceptible

Some synthetic rubbers are just as susceptible to microbial oxidation as natural rubber while others appear to be relatively resistant to microbial attack. The authors also state that in general unsaturated hydrocarbons are attacked more readily than saturated compounds, and long chains are attacked more readily than short chains. The oxidizability also seems to be the function of the number of side chains, iso compounds generally being more susceptible to bacterial oxidation than normal hydrocarbons. Most synthetic rubbers are long chain unsaturated hydrocarbons with many side chains attached.

Kalinenko *(5)* stated that *Aspergillus oryzae* and *Penicillium* species destroyed about 32 per cent of dispersed rubber (in a flask) in one month. *Actinomyces* destroyed 20 to 40 per cent. Several species of microorganisms did not assimilate the rubber.

Dawson *(6)* observed that crude raw rubber stored in Malaya decreased in weight due to attack by microorganisms to the extent of 75 per cent in 5 years.

Note: This article is based on a talk on "Prevention of Deterioration of Materiel" given by the author before the Washington Rubber Group at Washington, D. C., on April 13, 1948.

Vulcanization is not likely to make any of the hydrocarbon synthetic rubbers more immune from attack. Vulcanized natural rubber is well known to be attacked by oxidizing bacteria, while the account of sulfur bacteria and their activity in attacking concrete, cement and stone work, as well as organic materials, holds out little hope that synthetic rubbers can escape. This author speaks favorably of neoprene. This article in general does not reach any conclusions and merely states the confused situation in this field at the present time.

Englerth *(7)* reported that a sample of new Buna S and reclaimed Buna S rubber was tested for immunity to mold attack. The reclaimed Buna S appeared to be susceptible to serious mold deterioration, while the new, although not inhibiting moulds entirely, proved to be much more resistant.

Stief and Boyle *(8)* tested the effect of several fungicides on the aging properties of rubber samples and found that with the exception of copper-containing compounds no effect was noticed on aging.

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Sir John Hay on the Current Rubber Situation

One of the outstanding critics of the American synthetic rubber policy has been Sir John Hay, closely identified with the natural rubber producing industry and chairman of several plantation companies. His opinion of the current situation was recently summed up in an address at the annual meeting of the United Sua Betong Rubber Estates, Ltd., in London on June 7, 1948. The following extract of his talk is reproduced without comment.

IT HAS BEEN frequently stated that natural rubber has now to compete with the synthetic product, made chiefly in the U.S.A. Such a statement is only a half-truth masking the true position. Our American friends' devotion to the system of private enterprise and free competition is not so unqualified as to prevent them from departing from it when it seems to serve their interests to do so. Synthetic rubber has been put under the shelter of protective legislation well beyond the reach of the cold, blasting winds of free competition. Its use up to a minimum of 225,000 tons per annum is enforced by law and it is supplied to manufacturers from Government-owned factories at the fixed price of 18½ cents (U.S.A.) per pound.

The manufacturer, in his turn, is protected against the competition of tires made from natural rubber by the prohibition of the import of tires the content of which does not include a specified quantity of the synthetic substitute. So safeguarded from the competition of any superior tire made from natural rubber, U.S.A. manufacturers can and do, by arrangement amongst themselves, use more than the prescribed minimum of synthetic. There may at the present time be some degree of justification for that since the amount of natural rubber now available would be hardly sufficient to meet all trade requirements in excess of the specified minimum as well as demands for stockpiling in which the U.S.A. Government is now engaged. But the original impulse to do this comes from a determined intention to keep down the price of the natural product.

In the course of evidence given before a Congressional Committee, which led up to the present legislation, the view was expressed that the price of natural rubber should not be allowed to go above 20 cents (U.S.A.) per pound, and it seemed to be a matter for indignation, of varying degree, that it should have ever done so. This figure of 20 cents (U.S.A.) per pound was not reached by any careful computation based on the ascertained cost of production, nor by reference to prevailing values, nor, so far as one can detect, by any recognizable process of reasoning. It was an expression of emotion directed against the idea that the U.S.A. should have to buy an essential raw material from an overseas territory and at a price necessary to give the producer a profit.

It so happens that the present price of rubber has gone beyond this mystical figure of 20 cents, but this is not due to any relenting on the part of our American friends. In the expectation of lower prices resulting from greater quantities of rubber coming from Indonesia, there was a general holding off of buying by manufacturers. Owing to continuing unsettlement in that territory these expectations have not been realized. Trade buying can no longer be postponed, and the rubber available to meet these deferred purchases, as well as for stockpiling, is for the time being hardly adequate.

This fortuitous combination of circumstances may continue for some time and rubber producers, after a long interval, may enjoy the now somewhat strange experience of making some profit, although barely sufficient to permit of adequate sums being set aside for replanting and other prudent provisions, and of a fair payment to stockholders who, for the most part, have had no return for seven years.

Viewed in their wider context, these are matters which transcend the interests of the rubber producing industry. Rubber is still our (Britain's) greatest export to the U.S.A. and exceeds in value the total of all domestic exports from the United Kingdom. Even at the present improved price, which is largely fortuitous, calculated in terms of wheat and cotton, two of our chief imports from the U.S.A., it is only worth one-third of its 1940 value. With this continuing wide disparity in prices as between our chief export to and our main imports from the U.S.A., it is vain to expect that we can fill the gap in our trans-Atlantic trading account.

The official reason given for the present U.S.A. policy in the matter of rubber is national security. To serve that high purpose it is conceivable that other steps could be taken which would not entail a twin measure of total protection permitting practices which distort seriously our already ill-balanced international trade, which if not adjusted, will be productive of widespread distress.

Double Freezing Point Method for Styrene Purity

A SIMPLE method for the determination of the purity of styrene, particularly adapted to industrial process control, has been developed by Dr. J. F. Masi of the National Bureau of Standards, Washington, D. C. The method utilizes an empirical equation relating the percentage of styrene by weight in the sample to two freezing points obtained experimentally with specially designed apparatus. One of these freezing points is taken on a part of the original sample while the other is determined from a portion of the sample from which the more volatile hydrocarbon impurities have been removed by evaporating and recondensing the styrene. This procedure, which was devised for the Office of Rubber Reserve, Reconstruction Finance Corporation, is now in use in all of the Government-controlled plants making GR-S.

Importance of Styrene Purities

GR-S is produced by the polymerization of a mixture of styrene and butadiene. The styrene which is fed to the reactors in the manufacturing process is a blend of fresh styrene with that recovered by steam distillation at the end of the reaction. Fresh styrene is pure, except for a residue of less than one percent of the ethylbenzene from which it is obtained, but recovered (or "recycle") styrene contains no more than 85 to 90 percent of the pure substance. For calculation of plant inventories and plant efficiencies, and in order to produce rubber of uniformly high quality, it is necessary to know the purities of both the fresh and recycle styrene and to closely control the amount of styrene in the blend made from them.

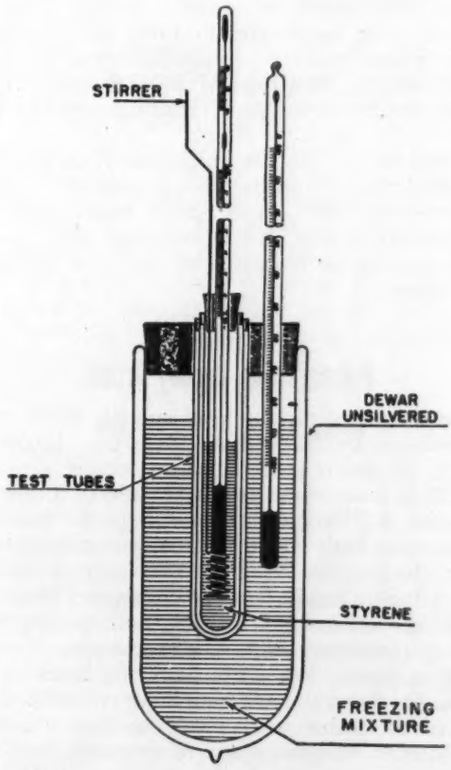
Measurement of freezing point depressions is one of the most convenient ways of determining the purity of hydrocarbon compounds. However, for routine work in industrial laboratories the necessary time, personnel, and equipment are not always available for the more accurate technique using platinum resistance thermometers. The Bureau has therefore developed a practical freezing-point procedure which may be applied effectively and efficiently by an operator who lacks technical training.

The principal impurities in recycle styrene are ethylbenzene, 4-vinylcyclohexene (butadiene dimer), and 1,3-butadiene; comparatively small amounts of other hydrocarbons are also present. A single good freezing-point value would suffice to determine the purity of a styrene sample if only the molecular percentage purity were desired and if all of the impurities formed ideal solutions with styrene. However, in practice it is necessary to know the percentage purity by weight; moreover, ethylbenzene and 1,3-butadiene do not form ideal solutions with styrene.

The difficulties are overcome in the method developed at the Bureau by removing the butadiene and any other volatile impurities and obtaining the freezing point of the mixture of styrene, ethylbenzene, and 4-vinylcyclohexene which remains. This freezing point, together with the freezing point of the original sample, is then used to calculate the purity of the styrene.

The separation of low boiling impurities is accomplished by completely evaporating a 15-ml portion of the sample under low pressure and passing the vapor through a trap kept at —65° C. The styrene, ethylbenzene, and 4-vinylcyclohexene solidify on the walls of the trap while the light hydrocarbons pass through without condensing. The apparatus required is easily constructed and produces more efficient separation than ordinary distillation.

The empirical equation relating the weight percentage of styrene to the two freezing points assumes that no important impurities other than those mentioned are present and that ethylbenzene and 4-vinylcyclohexene occur in nearly equal amounts. The application of this equation is greatly simplified by the use of a large-scale nomogram prepared for the convenience of industrial laboratories.



Apparatus designed for determining the purity of recycle styrene from freezing point data.

Determining the Freezing Points

The freezing points are obtained by a procedure designed to provide the highest possible accuracy consistent with the rapid taking of observations by relatively untrained personnel. The styrene is placed in the innermost of a nest of three test tubes immersed in a chloroform-carbon tetrachloride freezing mixture contained in an unsilvered Dewar flask. Throughout the determination, the sample is stirred at the rate of about 150 strokes per minute by a motor-driven stirrer, and the bath is maintained (by addition of small pieces of dry ice) within 0.5° C. of the temperature selected so

that the rate of cooling of the sample while freezing, is near 0.1° C. per minute.

The temperature of the sample is observed every half-minute as it is being cooled, beginning a few minutes before freezing is expected to occur and continuing at least ten minutes after freezing begins. As some undercooling always takes place, the actual freezing point is found by extrapolating the freezing curve back to the liquid cooling curve. This extrapolation is best performed by a geometrical construction proposed by Taylor and Rossini [*J. Res. Nat. Bur. Standards*, Vol. 32, p. 197 (1944)]. The freezing point obtained by extrapolation is then corrected by applying the thermometer-calibration and emergent-stem corrections.

In order to realize the greatest possible accuracy in this work, a liquid-in-glass thermometer readable to 0.01° C. has been designed at the National Bureau of Standards. The thermometric liquid is a thallium amalgam which remains fluid below the lowest temperatures likely to be encountered in styrene analyses. Thermometers of this type are now available commercially and may be calibrated by the Bureau.

The accuracy of the freezing points is also enhanced by frequently checking the apparatus and procedure with a material of known freezing point. Bromobenzene is excellent for this purpose as it is available in purity greater than 99 percent and does not readily deteriorate. The freezing point of bromobenzene is —30.75° C. while that of pure styrene is —30.63° C.

Sixty-eight styrene solutions containing various amounts of ethylbenzene, 4-vinylcyclohexene, and 1,3-butadiene were employed in investigating the method and in developing the empirical equation for calculating styrene purity from the two freezing points. The reproducibility of freezing points of the same solution, when obtained by different operators using different thermometers, is within 0.03° C. The efficiency of separation of butadiene was judged by comparison of freezing points obtained both before adding, and after removing, the butadiene.

These experiments indicate that variation in the amount of butadiene (up to three percent) does not affect the sharpness of separation, but it was found that a large concentration of the heavier impurities may cause a small amount of the 4-vinylcyclohexene to be pumped out during the separation and thus to be calculated as butadiene.

From a consideration of the assumptions involved and the deviation of calculated from actual percentages of styrene in the prepared solutions, the probable error of the method is estimated at ± 0.15 percent of styrene for 90-percent styrene solutions.

Rubber Situation in the Netherlands Indies

EXPORTS of crude rubber from the Netherlands Indies in 1947 amounted to 85,323 metric tons, valued at 67,788,000 guilders ($25,759,000), according to official statistics reported by the U. S. Department of Commerce. These figures are incomplete, however, since they do not include shipments from the Republican territory of Sumatra or rubber smuggled out of Borneo and other territories under Dutch control. Including shipments from these areas, rubber exports from the Netherlands Indies in 1947 are estimated to have totaled 295,150 metric tons.

Although only about 33,000 metric tons are officially recorded as having been exported to the United States, it is believed that, in addition, considerable quantities of rubber were shipped direct from Singapore to the United States.

Only a small part of the rubber exported from the Netherlands Indies in 1947 was estate grown. Few rubber estates were in Dutch hands before the July advance. The advance brought 70 percent of Java's present rubber area and 61 percent of the plantation area on the east coast of Sumatra within the Dutch lines.

Of the 393 rubber estates in the reoccupied districts of Java, 171 had been taken over by the end of 1947, and production had been resumed on 90 estates. Of the 134 rubber estates in the reoccupied districts of Sumatra's east coast, 78 had been taken over by the close of the year and production had been resumed on 46 of them. In Sumatra, 37 of the processing plants were found virtually in running order, 37 were readily repairable at moderate cost, and only 4 were seriously damaged. Eighty-nine of the factories on the estates taken over in Java were found practically in running order, 49 easily repairable, and 33 seriously damaged.

It is difficult to forecast production, even in the immediate future, because it depends on the speed with which peace is restored in the rubber districts, the security afforded further investments, the availability of foreign exchange, and the time it takes to obtain machinery and spare parts from abroad.

It is estimated, however, that under favorable circumstances, 80,000 tons of rubber should become available from plantations in Sumatra during 1948, about 30,000 tons from the estates in Java, and 250,000 tons of native grown rubber principally from Borneo and southern Sumatra, or a total of 360,000 tons. This estimate may be conservative if rehabilitation progresses rapidly.

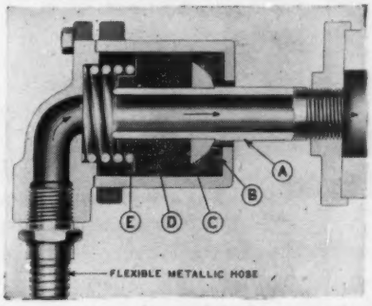
(EDITOR'S NOTE: Rubber shipments from the Netherlands Indies through official Dutch channels during the first quarter of 1948 totaled 52,796 metric tons valued at $16,990,000 at the official exchange rate, according to latest information compiled by the U. S. Department of Commerce.)

Palmer-Shile Carboy Truck

A new safe way to handle chemicals, acids, etc., has been developed by the Palmer-Shile Co., 12657 Mansfield Ave., Detroit 27, Mich., manufacturers of carboy trucks. This is accomplished by the use of a new carboy truck which is designed to speed up the handling of dangerous chemicals or any liquid generally encased in a carboy. In use, the truck is rolled up against the carboy and a handy gripping yoke is dropped over the top, the truck handles are pulled back, and loading becomes automatic. Hardened steel studs on the truck frame hold the load in place. For unloading, the truck is simply tipped forward and the gripping yoke released. The new carboy truck features all steel welded construction, curved handles to assure secure gripping, and rubber, metal or pneumatic wheels depending on individual requirements. Its over-all width is only 20 inches and its over-all length is 48 inches. It has a capacity of 500 pounds and weighs 75 pounds.

Self-Supporting Pressure Joint

A self-supporting rotary pressure joint which requires no external piping support has been announced by the Johnson Corporation, Three Rivers, Mich. Known as the Type-S Johnson Rotary Pressure Joint, it will be used like the standard Johnson Joint to admit heating or cooling agents to rotating rolls, particularly where considerable lateral movement of rolls is encountered, or



where supports for the standard Johnson Joint can not be satisfactorily provided.

Like all Johnson Rotary Pressure Joints, the new Type-S is completely self-lubricating, has no packing of any sort, and adjusts itself automatically for varying pressures. Like the other Johnson Joints, too, it has a spherical sealing surface which maintains an effective seal even though wear should occur at this point.

In this new Type-S, a large bearing or guide of carbon graphite supports the entire weight of the joint. It is accurately fitted inside the body, where it provides a bearing surface on the rotating nipple. The seal proper is effected between a hemispherical collar on the nipple and another carbon graphite bearing ring. Pressure itself is the sealing force—the higher the pressure the tighter the seal.

The carbon graphite used in the new Type-S is the special material used in Johnson Rotary Pressure Joints for many years. It requires no oiling, since any moisture in the joint acts as a suitable lubricant. Standard construction has cast iron head and body with steel nipple. The Type-S is also available with bronze trim—bronze body and nipple—or all bronze with stainless steel spring.

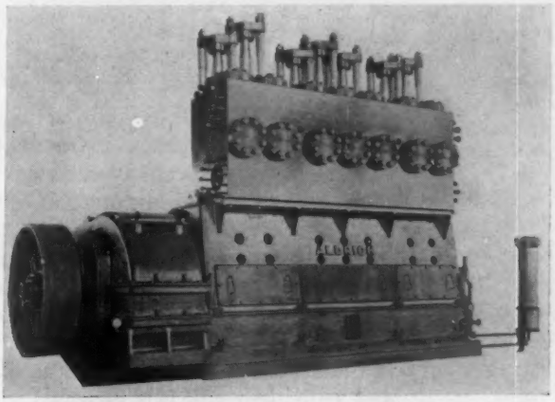
The Johnson Type-S Rotary Pressure Joint can also be furnished to provide for syphon drainage pipes, to remove condensate through the same head that admits the steam. Four sizes are available—½", ¾", 1", and 1¼"—all suitable for 150 lbs. pressure, temperatures to 400° F.

Roberts 300-AC Air Valve

The Halkey-Roberts Corporation, Paramus, N. J., has developed and introduced the Roberts 300-AC Valve for direct sealing to vinyl film. The valve features a heat-sealing flange and valve body made of rigid polyvinyl chloride with excellent heat-sealing characteristics. The vinyl film may be heat-sealed on top of the valve flange or under the flange. Suitable for application on all types of inflatable vinyl items, the new valve has a number of features including the following: attractive in appearance, leak proof, corrosion resistant, can be mouth or pump operated, and can not cause injury. Like other types of valves made by the company for use with atomizers, rubber boats, toys, etc., the Roberts 300-AC Valve has non-removable stems to prevent injury by swallowing or inhaling. This features also prevents loss of stems.

Aldrich Standardized Pumps

A new design development of particular interest to users of high pressure pumps has been announced by the Aldrich Pump Co., Allentown, Penna. This company has standardized the design of 6-inch stroke Triplex, Quintuplex, Septuplex and Nonuplex and 7, 7½ and 8-inch stroke Quintuplex, Septuple and Nonuplex Pumps to permit use of identical wearing parts such as bear-



ings, crossheads, wristpins and valves regardless of plunger diameter and number of plungers. Increases in capacity are accomplished by increasing the number of pumping units. Pumps are supplied with 3, 5, 7 and 9 plungers.

In the 6-inch stroke line, the Triplex has a 300 hp rating, the Quintuplex has 500 hp, the Septuplex has 700 hp and the Nonuplex carries the hp rating to 900. The 7, 7½, and 8-inch stroke pumps carry the ratings from 1,300 hp to 2,400 hp. Ring joint construction to all flanges can be incorporated, and, if interchangeability of plunger sizes is desired, stuffing box linings can be provided.

This type of design over a wide range of sizes will cut down investment in spare parts and will decrease inventory of spare parts. It will also greatly reduce complications in ordering and accidental duplication of parts. The accompanying illustration shows a 700 hp, 6-inch stroke, 8 main bearing, Aldrich Septuplex pump with built-in gear case.

A new **propeller-type agitator,** designed to agitate materials having consistencies up to 4%, is now being manufactured by E. D. Jones & Sons Co., Pittsfield, Mass. Anchored in the wall of any chest or tank, this cartridge type unit is complete and compact, and is furnished with an electric alarm system which sounds a warning if the water supply should fail.

The Kellogg Division, American Brake Shoe Co., New York City, has announced the availability of two **portable fractional-horsepower air compressors,** both of which produce 100 percent oil-free air. Special designing is said to have eliminated all contact or contamination of the air with lubricating oil. Both compressors are readily adjustable for different pressures.

Midget hydraulic units, suitable for automatic or remote control of hydraulic cylinders or as substitutes for compressed air when the latter is not available from a plant supply line, have been added to the line featured by the John Dusenbery Co., Montclair, N. J. The unit is available with pumps of various capacities and pressures to suit individual requirements, and includes a 5-pint capacity reservoir and electric motor.

Editorials . . . . . .

Wage Increases

SERIOUS labor trouble in the rubber industry has again been avoided as the result of negotiation, compromise and the application of common sense on the part of both management and labor. At this writing, both Firestone and Goodyear have signed new contracts with their respective union locals. The Firestone agreement formed the pattern for the Goodyear contract, and will probably serve as the basis for the U. S. Rubber settlement which is expected to be announced in the next several days. Although some trouble is current between Goodrich and the union, a similar settlement is anticipated.

The Firestone and U. S. Rubber wage settlements are for the same amount as that negotiated between the General Motors Corporation and the United Auto Workers, namely, an increase of 11 cents an hour. In all three instances, the unions requested an increase of approximately 30 cents an hour. The rubber agreements, however, call for a straight hourly wage increase and do not include an escalator clause with a cost of-living formula as does the General Motors contract. The rubber agreements run for two-year periods and provide that the wage clause may be reopened after one year upon 60-day notice. Both agreements negotiated to date cover working conditions in all domestic plants of the companies concerned.

Wage talks between Goodrich workers and the company were broken off in Philadelphia on June 6 after several days of negotiations. On June 17 union officials were given authority to call a strike. According to present law, no such strike could be started until July 12, when the 60-day "cooling off" period ends. According to union officials, Goodrich had offered an 8-cents-an-hour increase only, and insisted on a two-year contract. These officials insist that the union will not enter into any two-year agreement. Negotiations between the Goodrich management and labor are expected to be resumed shortly, however, and the Firestone-U. S. Rubber pattern will probably prevail.

An industry-wide strike, or even a company-wide strike, was especially to be avoided at this time. Like most other industries, the rubber field is currently going through its first post-war setback and is gearing itself for the competition which was inevitable. Major attention must now be paid to improving manufacturing processes and revamping marketing tactics. The proper combination of both of these factors benefits labor as well as management.

Rotation of Rubber

MANY rubber manufacturers are still not too familiar with the practices which have been established in connection with the rotation of natural rubber in the Government stockpile. Such rotation is in the hands of the Bureau of Federal Supply of the Treasury Department and every rubber manufacturer should make certain that he is receiving copies of the special schedules issued periodically by the Bureau.

Because changes in contract terms, conditions and specifications are made from time to time, prospective bidders should carefully examine the latest contract available. These contracts generally accompany the schedules issued by the Bureau of Federal Supply. The latest contract, for example, permits the direct sale of certain off-quality rubbers directly by the Bureau to a bidder without the necessity of the bidder contracting to replace a like amount of rubber. The Bureau reserves the right to determine which lots may be sold directly in this manner.

According to a review of the rotation scheme issued by the Rubber Manufacturers Association, the manufacturer has the following alternate possibilities for participating in the program: (1) He may bid directly for outright purchase of lots of natural rubber that are not of standard RMA quality with no obligation to replace with new rubber; (2) He may request his dealer to obtain for him any lot listed, and the dealer then will assume the obligation of replacing with new rubber or not, as the case may be; and (3) He may bid directly to the Bureau of Federal Supply on a price differential basis for a given lot, offering to replace a like quantity of ribbed smoked sheets, No. 4 RMA type or better.

Interested bidders are given the option of inspecting any lot of rubber in which they may be interested. After application is made, an inspection order is issued and the inspection may be made. The inspection orders, however, do not include the privilege of drawing samples. The rubber is rotated on a price differential basis with all tenders to be made by the Government and the contractor within any 30-day period.

As indicated in our news pages, John B. Ingle, formerly associated with the Goodyear organization on rubber procurement for many years, has joined the staff of the Bureau of Federal Supply as rubber consultant. Further data on rubber rotation can be secured from Mr. Ingle or from J. J. Wolfersberger of the same staff. Both are located at the Washington, D. C., headquarters.

CURRENT NEWS OF THE MONTH

PROGRAM COMPLETED FOR THE RUBBER TECHNOLOGY CONFERENCE

The program for the Rubber Technology Conference to be held in London, England, on June 23, 24 and 25, under the auspices of the Institution of the Rubber Industry has been completed. In all, 43 technical papers will be presented and two special events will be held.

The special events include a demonstration of the physical and chemical properties of rubber, by E. F. Powell, of the Dunlop Rubber Co., Ltd., to be given on the afternoon of June 23, and an open discussion on tensile, hardness, abrasion and tear of vulcanized rubber, to be held on the afternoon of June 24.

A number of additional papers have been approved for presentation at the Conference since the list we published in our March, 1948, issue. The titles of these papers, together with their authors, follow:

List of Additional Papers

Preparation and Properties of Buna N-Type Copolymers, by J. F. Nelson and B. M. Vanderbilt.

Vulcaprene—Some New Compositions of Special Interest to the Spreading Industries, by D. A. Harper, W. F. Smith, and H. G. White.

Alteration of Neoprene by Polymerization Temperature, by H. W. Walker and W. E. Mochol.

Kinetic Study of Rubber Oxidation, by J. Le Bras and A. Salvetti.

The Degree of Crystallinity in Natural Rubber, by J. M. Goppel.

Limiting Factors in the Mathematical Design of Rubber Suspension Units, by H. L. Jenkins and D. H. D. Cooper.

Free Retraction of Elongated Rubber, by B. B. S. T. Boonstra.

Experimental Methods in the Osomometry of Dilute Rubber Solutions, by H. W. Melville.

Tear Resistance of Vulcanized Rubber, by H. A. W. Nijvold.

Tear Initiation and Tear Propagation, by J. M. Buist.

A Tack-Meter for Rubber Testing, by E. W. J. Beaven, P. G. C. White, G. J. Garner, and G. Rooney.

Fresh Hevea Latex—A Complete Colloidal System, by L. N. Homans and G. E. van Gils.

Preparation and Properties of Highly Purified Rubber, by G. Martin.

The Possibility of Using Tannins as Coagulants, by H. A. Leniger and G. Verhaar.

Theory of Filler Reinforcement. II, by E. Guth.

Light Phenomena of Compounded Rubber, by A. van Rossem.

Effect of Pigments on Elastomer Properties, by L. H. Cohan.

New Principles in the Manufacture and Use of Factice-Like Materials, by J. H. Carrington and K. C. Roberts.

The Effect of Carbon Blacks on the Viscosity of Rubber, by I. Drogin.

The Nature and Properties of Carbon Black Surfaces, by W. R. Smith.

Structures in Rubber Reinforced by Carbon Black, by A. F. Blanchard and D. Parkinson.

The Compounding Significance of Carbon Surface, Structure and pH, by D. F. Cranor.

Applications of High Tenacity Rayon in the Rubber and Plastics Industries, by D. Finlayson and T. Jackson.

Testing and Use of Rayon for the Manufacture of Tires, by G. Fromandi.

Latex Reclaim-Casein Adhesive Solutions, by E. R. Gardner and P. L. Williams.

Four Official Banquets

Four official banquets are planned during the Conference. A Conference Luncheon will be held at the Central Hall, Westminster, on June 23, the opening day of the Conference. That evening, a dinner will be given by the Imperial Chemical Industries, Ltd., at the Park Lane Hotel. A luncheon will be given at the Trocadero, Piccadilly, on June 24, by the British Rubber Producers' Research Association and the Research Association of British Rubber Manufacturers.

The highlight of the official banquets will be the Conference Dinner at the Connaught Rooms, Kingsway, on the evening of June 25. On this occasion, the President of the Institution of the Rubber Industry will present the Colwyn Gold Medal to Dr. R. P. Dinsmore, vice-president of the Goodyear Tire & Rubber Co. John F. Coleman is Conference Secretary.

Recovery of Rubber

A process for the recovery of rubber in plants by fermentation of the leaves with clostridium is covered in U. S. Patent No. 2,440,554, the rights to which have been assigned to the U. S. Department of Agriculture. The process comprises fermentation of the leaves by organisms which digest the cell walls, mild mechanical action to detach the rubber-containing protoplasts from the plant debris, separation of the protoplasts from the debris by screening, digestion of the protoplasts with alkali to release the rubber globules, and separation and recovery of the rubber as latex.

GR-S INVENTORY LIMITATION REMOVED BY NEW AMENDMENT

Further amendment of Rubber Order R-1 by the Department of Commerce, announced on May 26, has resulted in the removal of maximum inventory limitations on general purpose synthetic rubber (GR-S). The amended order, officially known as Rubber Order R-1, As Amended May 25, 1948, also extended the area of mandatory use of butyl (GR-I) in the manufacture of inner tubes.

In regard to the inventory factor, it was emphasized that GR-S will remain under allocation, but that production is now sufficient to permit accumulation of normal inventories by manufacturers. For the past three months, inventories have been held to amounts sufficient to produce not more than 20 days' supply of finished goods. Officials said the relaxation will provide more rubber to distribution channels, and expressed the hope that removal of inventory control would result in greater voluntary use of general purpose synthetic, in the interests of national security.

Broadening the base of mandatory use of butyl to include medium-size truck and bus inner tubes, without requiring additional total consumption of the synthetic, will permit manufacture from natural rubber of up to 20 percent of all tubes in each size group, including the popular passenger car sizes. This will make it possible for manufacturers to supply natural rubber tubes to extreme northern areas of the United States where some butyl tubes have been found to be adversely affected by low temperatures.

Earl W. Glen, Chief of the Rubber Division, said that improvements in the quality of butyl, and of tubes made from it, are expected to result in the "not distant future" in a product that will be fully adequate under all conditions.

Other significant changes in the amended order include the following:

(1) The section on "Definitions" now makes it clear that all general purpose and special purpose synthetic rubber referred to in the order means only such rubber as produced in the United States.

(2) The term "reclaimed rubber" is defined as "any material derived from the processing or treatment of vulcanized rubber or cured scrap rubber."

(3) The manufacturing regulations now provide that in cases where specifications for tires, tubes and flaps provide for a group average or tolerance such group average or tolerance must be balanced out each calendar month.

(4) A provision has been added in the specifications pertaining to tire flaps (in Appendix A) to the effect that no individual flap in the specified group shall contain less than 6% GR-S.

SYMPOSIUM ON SYNTHETIC FEATURES MEETING OF CHEMICAL ENGINEERS

A symposium on chemical engineering developments in the synthetic rubber program featured the regional meeting of the American Institute of Chemical Engineers, held at the Hotel Hollenden, Cleveland, Ohio, May 9 to 12. Five papers were presented at an afternoon session on May 10. W. I. Burt, vice-president of the B. F. Goodrich Chemical Co., presided over the symposium.

The first paper, "Development of Large Scale Emulsion Polymerization in the GR-S Program," by J. T. Cox, Jr., and Paul S. Forsyth of the Reconstruction Finance Corporation, Office of Rubber Reserve, Washington, D. C., discussed the development of major apparatus used in the polymerization of butadiene-styrene type rubbers produced in the Government program. A short synopsis of the laboratory work leading to large scale design of the present reactor was given, as well as the improvements that have been incorporated during the operation of the present program.

Drying Process Described

"The Porous Sheet Process For Drying GR-S Synthetic Rubber," was the title of the second paper, given by W. F. Bixby of the B. F. Goodrich Chemical Co., Cleveland, Ohio. The author stated that the drying of GR-S requires the diffusion of heat into and the diffusion of water vapor out of the rubber following the coagulation process. Both of these operations can be hastened by drying the rubber with air at high temperatures.

However, the physical properties of GR-S are adversely affected by prolonged exposure to hot air and as a result many synthetic rubber driers are designed to function at moderate temperature levels, the speaker stated. These operating conditions result in slow drying rates, necessitating considerable production holdup, thereby requiring large driers of heavy construction.

The porous sheet process was developed to obtain a high quality rubber under rapid drying conditions. The rubber is coagulated in the form of small uniform crumbs which are formed into a thin porous sheet with sufficient mechanical strength to be conveyed through a drying chamber. Because of the small crumb size, relatively high temperatures can be employed to dry the rubber so rapidly that the physical properties are not adversely affected.

This makes it possible to utilize a dryer of light weight construction, which will contain only a small amount of rubber in process. This type of dryer permits close control of drying operations, thereby minimizing the chances of producing sizable quantities of off-grade stock and reducing the magnitude of fire hazards in the dryer. The history of the development of the process was summarized and the operating characteristics of the equipment discussed.

Continuous Polymerization

The third paper of the symposium was entitled "Some Factors Affecting the Continuous Polymerization of Synthetic Rubber," by D. H. Francis and H. R. Sontag of the Goodyear Synthetic Rubber Corporation, Akron, Ohio. According to the authors, continuous flow was first applied to plant scale GR-S polymerizations early in 1944. Since then continuous GR-S polymerization has been employed in many of the Government plants.

Three different types of charging equipment have been used, namely, positive displacement proportioning pumps, rotameter flow controllers, and orifice flow controllers. The reaction vessels consist of the original batch type reactors connected in series. These reactors are jacketed pressure vessels cooled by water circulation to remove the heat of the reaction. At the end of each reactor chain, a series of ten displacement tubes provided with shortstop addition points are employed for reaction control.

Control of the ratio of charge vessels is maintained by the charging equipment, according to the authors. Viscosity tests are conducted on polymer obtained from latex leaving the displacement tubes and the point of shortstop addition is adjusted accordingly. The proportion of chain modifier charge is controlled to obtain a constant monomer conversion at a constant viscosity.

The reaction may be temporarily suspended by chilling to 80° F. If a prolonged shutdown is required, the reactors are isolated and reacted out batchwise. Raw material variations are primary factors influencing the polymerization. Of these, variations in soap and variations in certain monomer impurities are the most important.

Monomer Recovery Process

"The Development of the Monomer Recovery Process in the GR-S Program," by C. R. Johnson and W. M. Otto of the Firestone Tire & Rubber Co., Akron, Ohio, was the fourth paper of the symposium. This paper dealt with the chronological development of the batch and continuous processes for recovering unreacted butadiene and styrene from GR-S latex.

It was the purpose of the report to show how this typical problem in chemical engineering plant design evolved from the basic idea through the stages of laboratory investigation of the properties of the raw materials and product involved, through the pilot plant stage, and finally to the design of the plant scale batch and continuous processes. Each of the recovery processes was then followed from the original design to actual plant operations, and the problems involved and changes made to improve the efficiency and economy of operations were discussed.

The fifth and last paper of the symposium was entitled "Latex Incorporated Carbon Black For Synthetic Rubber," by John C. Madigan and James W. Adams of the U. S. Rubber Co., Naugatuck, Conn. The authors stated that the conventional methods used for the mechanical dispersion of carbon black in rubber while in solid form, utilizing ponderous machinery and large quantities of power, have been supplanted to a considerable degree by a process yielding the product called GR-S Black Masterbatch.

The basic principle of this process involves mixing the two solids while in liquid form as slurries or dispersions, and latices having known solid content, and the subsequent coagulation of the solids from the resultant mixture. Pertinent chemical and engineering problems encountered and flow sheets of commercial installations now in operation together with the economic and quality advantages of this versatile development were presented.

Discusses Redox Process

Recent deevlopments in the so-called Redox process, which makes it possible to manufacture synthetic rubber at low temperatures, were discussed by Professor Carl Shipp Marvel of the University of Illinois on May 20. Dr. Marvel delivered the Edgar Fahs Smith Memorial Lecture, sponsored jointly by the Philadelphia Section of the A.C.S. and the University of Pennsylvania, at Franklin Institute on that date. In his lecture, Dr. Marvel stated that in another approach to the problem of improving synthetic rubber, chemists have tried substituting various other compounds for butadiene and styrene in the basic GR-S formula. For example, he said, isoprene and piperylene have been used in place of butadiene with surprising results. When a commercial grade of isoprene was employed, the polymerization reaction proceeded slowly, but when extremely pure isoprene is compared with extremely pure butadiene, the isoprene seems to polymerize faster. An explanation of this apparent anomaly, according to Dr. Marvel, is that in ordinary isoprene some of the molecules are combined in pairs, and these double molecules poison the reaction. Piperylene also polymerizes too slowly to be of great use.

Exposition Set For October

Plans for the fifth National Chemical Exposition to be held October 12 through 16 at the Coliseum in Chicago, Ill., include the revival of the National Industrial Chemical Conference, which was not scheduled at the last show held in 1946. The Chicago Section of the American Chemical Society, sponsor of the biennial expositions, called off the Conference in 1946 in order to cooperate fully with the important fall meeting of the ACS held during the period of the Show. The Conference will feature noted speakers who will present interesting papers on new developments, discoveries and applications in industrial chemistry.

Building Fatty Acid Plant

The Chemical Division of Blaw-Knox Co., Pittsburgh, Penna., has been awarded a contract by Lever Bros. Co. to design and erect at Hammond, Ind., a complete fatty acid production plant. The fatty acids will be refined by distillation and used by Lever Bros. in their products. The plant will be constructed of stainless steel and aluminum. Construction is to begin immediately and the unit is scheduled to go into production in the near future.

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C.I.C. RUBBER DIVISION HOLDS MEETING IN MONTREAL

The Rubber and Plastics Division of the Chemical Institute of Canada held its best meeting to date at the Windsor Hotel in Montreal, Canada, on June 9 in conjunction with the 1948 Conference and Exhibition of the parent society. Approximately 140 members and guests were in attendance at the Division meeting.

Eleven papers were presented at the meeting, which featured technical sessions in the morning and afternoon. Of these, three papers constituted a symposium on "Comparison of Synthetic Rubber and Natural Rubber in Tires and Tubes, Mechanical Rubber Goods, and Footwear." One of the scheduled papers, "A Moisture-Sensitive Accelerator System for Elastomers," prepared by S. T. Bowell and N. R. Legge, both of the Polymer Corporation, was withdrawn. The following papers were presented:

Deformation Characteristics of Rubber or Rubber-Like Compounds as a Measure of Quality, L. V. Cooper (Firestone); *Quality Control of Factory Mixed Batches of Rubber Compounds,* P. E. Gnaedinger (Dominion Rubber); *Oxidized Lignin as a Reinforcing Agent for Rubber,* R. A. V. Raff and G. H. Tomlinson (Howard Smith Paper Mills), and T. L. Davies and W. H. Watson (Polymer Corp.); *Lignin as a Stabilizer in GR-S,* W. H. Watson (Polymer Corp.).

Also, *The Formation and Structure of Vulcanizates,* J. A. Bardwell and C. A. Winkler (McGill University); *The Role of Aggregating Conditions and Particle Fusion in the Growth of Polymer Particles during Emulsion Polymerization,* C. E. Rhines and J. McGavack (U. S. Rubber); *Vinyl Paste Technology,* M. Scott Moulton (Goodrich Chemical); *Impact Resistant Rubber-Resin Blends,* H. S. Sell and R. J. McCutcheon (Goodyear). Abstracts of all of these papers were published in our May, 1948, issue.

Presentation of Symposium

The comparison symposium consisted of three 15-minute papers. The speakers were: G. R. Smye (Canadian Firestone), on tires; C. L. Brittain (Gutta Percha & Rubber), on mechanical goods, and A. B. Lewis (British Rubber), on footwear. All three speakers did an excellent job.

In comparing natural and synthetic rubbers from the standpoint of tires, Mr. Smye considered four factors: raw materials, processing characteristics, physical properties, and quality of finished products. In handling and storing, he said, GR-S and GR-I are far superior to natural rubber in all respects. In processing, although GR-S requires considerably more power than natural, the reverse is true in the case of the 15-inch plasticator. In the latter instance, Mr. Smye stated, his company can plasticate more GR-S-AC per hour and use less power than is the case with either smoked sheet or amber grades.

With regard to physical properties, the speaker said that so far natural in tires is superior to GR-S, having lower hysteresis and better abrasion, as well as better tensile, resilience and tear resistance. On the other hand, GR-S compounds show good aging properties, and GR-S appears superior to natural in sidewall performance. Commenting on end product quality, Mr. Smye said that tires today are 10 to 25% superior to the best all-natural rubber tires made before the war, but considerable credit is due to changed construction characteristics, such as flatter and wider treads, lower stretch fabric, etc.

Mr. Brittain, the next speaker, who discussed comparison of the two types of rubber from the mechanical goods standpoint, first emphasized the fact that the mechanical goods manufacturer has numerous products to consider and must use a wide variety of compounds. He mentioned the following: *Frictioning,* GR-S puts less rubber on the fabric, which means the use of additional skim coats; *Extrusion,* natural rubber has advantage, but progress being made with GR-S compounds; *Molding,* natural and synthetic rubber are on a comparable basis; *Hard Rubber Goods,* compounds call for the use of some natural rubber.

In Mr. Brittain's opinion, the major limitation of GR-S is the fact that in order to secure any specific property other properties must be sacrificed. Although this is also true of natural rubber, he said, the loss of other properties is not as great as with GR-S. In concluding, Mr. Brittain said that for certain products, such as heat-resisting conveyors and steam gaskets, GR-S held an advantage over natural rubber and will probably continue to be used.

In comparing natural and synthetic rubber in the manufacture of footwear, Mr. Lewis, the final speaker in the symposium, first pointed out that the use of either product was more economic than technical. He said that GR-S had proved completely satisfactory for all footwear parts, including uppers, but that natural rubber continues to be used for all cementing operations. The manufacture of footwear was traced by the speaker with slides.

Since cost factors are the dominating note in the manufacture of footwear, Mr. Lewis devoted a good portion of his talk to such factors. He compared the compound costs of soles, uppers and linings, and indicated that on the basis of present prices of the raw material, GR-S has an advantage. GR-S is particularly desirable for sole stocks, he added, and natural rubber would have to drop far below present prices before his company would use it in such stocks.

1948-49 Officers Elected

The business session, held between technical sessions, featured a discussion of the proposed by-laws and the election of officers. A motion was made and approved that further handling of the by-laws be placed in the hands of the incoming executive committee for final approval of the membership, probably by letter ballot. It was also announced that the 1949 meeting of the C.I.C. will be held in Halifax, Nova Scotia, and that the Division would organize a program for that meeting. The following officers for 1948-49 were elected:

Chairman, Harold G. Deline (Dunlop Tire & Rubber Goods); *Vice-Chairman,* J. Ramsay (Gutta Percha & Rubber); *Secretary-Treasurer,* J. T. Black (Polymer Corp.). The following were elected to the Executive Committee: G. D. Stevens (Canadian Goodyear), N. W. Smith (Dominion Rubber), and R. B. Marr (Naugatuck Chemicals). G. R. Smye (Firestone) was chairman of the Nominating Committee.

The photographs above depict operations in the new development laboratory of American Anode, Inc., in Akron. On the left, Richard L. Fee, Jr., is preparing a crib toy by the Anode coagulant deposition process. On the right, Robert W. Pemberton is discharging a Szegvari laboratory attritor in the preparation of an experimental latex compounding dispersion.

CONFERENCE COVERS ELECTRICAL ENGINEERING PROBLEMS IN INDUSTRY

The American Institute of Electrical Engineers Sub-Committee on Rubber and Plastics Industries, in conjunction with the Akron Section, held a conference on electrical engineering problems in the rubber and plastics industries on April 20, at Akron, Ohio. The conference included the presentation of seven papers.

Among the papers presented at the conference was "Electrical Power Systems for Small Rubber Plants," by B. D. Morgan (Johnson & Johnson), R. S. Ferguson (Goodyear), and H. J. Finison (General Electric). Upon investigating the power distribution problems of a number of small rubber and plastics plants, the authors found that the problems were remarkably similar. In view of this, a complete study of one plant was found to be worthwhile, since the information could be used in a large number of plants of this small size.

The main study was concerned with the selection of the proper voltages. The studies revealed that in all cases a 440 voltage power distribution system was the least expensive, but that, due to other considerations, such as convenience and the possibility of future expansion, a 2300 voltage system was the most desirable. Another point under consideration was the choice of using wound rotor motors or of increasing the transformer capacity to reduce the voltage dip which presents a problem in plants of this size.

Electrical Equipment Rooms

"Separate Electrical Equipment Rooms vs. N.E.M.A. Enclosures For Protection of Motors and Controls," by F. A. Green (Goodrich), was the title of another paper presented at the conference. According to the author, electrical equipment used in the manufacture of rubber and plastics products is subject to many injurious influences such as corrosive atmosphere, abrasive and conductive dusts plus an abundance of dirt that imbeds itself in every crevice and clings tenaciously to every surface. Hazardous atmospheres are common and inflammable materials are ever present.

In the selection of electrical equipment and its installation, the operating conditions must be anticipated, the factor of cost must be considered, as well as the actual matter of production. Original cost, however important, must not be minimized at the expense of excessive maintenance and lost production, Mr. Green added.

The author defined an electrical equipment room as one exclusively devoted to electrical equipment, accessible only to qualified personnel, free from combustible material and free from deteriorating agencies as moisture, gases, fumes, vapors, liquids or excessive temperature. The room should conform to the provisions of the National Electric Safety Code.

Electrical equipment must be protected against insulation impairment by excessive ambient temperature, against rapid deterioration of insulation by injurious agents present in surrounding atmosphere, against collection of dust and dirt in the ventilating ducts and passages which seriously hinder or obstruct normal ventilation, against grounding or short-circuiting of exposed live parts such as collector rings or commutators by dripping liquids, falling metal particles, dirt, dust or oil.

The author then presented a listing of some typical N.E.M.A. enclosures, and proceeded to compare the advantages or disadvantages these offered when compared with typical electrical equipment rooms. Summarizing his position, Mr. Green stated that for motor applications:

(1) Totally enclosed motors should be considered for all general purpose applications.

(2) Location of large motors in equipment rooms permits the use of least expensive motors and results in minimum maintenance.

(3) Separate ventilation should be considered for large motors in production area.

(4) Large slow speed motors, 100-150 rpm tolerate dirty conditions better than higher speed types.

For control applications, the speaker recommended:

(1) On the basis of cost and maintenance, controls for hazardous processes should be located in a separate room.

(2) Special control enclosures have the disadvantage of being expensive and impose additional burdens on maintenance.

(3) Equipment rooms have the disadvantage of requiring ventilation equipment and more conduit work.

(4) The advantages of controls in separate rooms are: improved production conditions, less chance of accidental damage, less expensive controls, reduction of maintenance cost, greater reliability, and reduction of hazards to life and property.

Electric Drive Characteristics

The conference also featured a paper on "Classification of Electric Drive Characteristics for Rubber Machinery," by A. T. Bacheler (Westinghouse). Mr. Bacheler discussed drive characteristics for such machines used in the rubber industry as Banbury mixers, plasticators, mills and mill lines, extruders and tubers, and calenders. He also covered two recent developments in motors used in this service. One was a so-called rubber mill type of field coil for synchronous motors, the other a copper fin construction for stator cores of synchronous, squirrel cage and wound rotor motors that makes possible smaller totally-enclosed fan-cooled motors.

Mr. Bacheler pointed out that while a two-speed drive with a ratio of speeds in the order of 2 to 1 is advantageous for Banbury mixers, the simpler single-speed drive is adequate for plasticators and mills and mill lines. Five combinations of dual-speed drives were covered involving both synchronous and induction motors. According to the author, a multi-speed drive with a range of 4 to 1 or 5 to 1 is required for extruders and tubers and calenders. This is best accomplished through the use of adjustable voltage d-c drives, he stated.

Also featured at the conference was a paper on "Stopping of Rubber Mills and Calenders by Electrical Means," by B. J. Dalton (General Electric). This paper reviewed the several methods of electric braking commonly used for stopping rubber mills and calenders and the factors which influence stopping. Dynamic braking of synchronous motors was described as the most desirable braking system for mills.

Plugging of induction motors was also discussed, as was dynamic braking and regenerative braking performance data for typical d-c rubber calender motors, together with a discussion of the factors affecting stopping performance of motors with speed control. The merits of different control systems as they affect stopping, together with typical performance data, was presented. Simple formulas which indicated methods of determining stopping performance were included.

Measurement of Tension

H. L. Smith (General Electric) presented a paper on "The Measurement and Control of Tension and Its Relations to Motor Input." According to Mr. Smith, one problem in driving processing trains in the rubber industry is the measurement and control of fabric tension. Many methods of controlling tension are used: the weight of the festoon platform, the dancer roll, or the armature current in a direct current motor. The last method, which has many advantages, has been very successfully used, but has the drawback that armature current is not a direct measure of fabric tension.

Examination of the fundamental characteristics of the DC motor, that is, the relation between armature current, flux and torque; the relation between speed, voltage, IR drop and flux, show the effect of IR drop and why constant armature current can be successfully used for tension control.

The effect of mechanical losses in the driven unit is to reduce the accuracy. With fixed diameter rolls, if these mechanical losses remain constant, they can be compensated for. The effect of mechanical losses in wind up, center driven rolls is quite different. Constant HP is required to maintain constant tension at any one fabric speed. As the roll builds up in diameter, the torque must increase in proportion, and the mechanical losses make fabric tension too low with an empty roll and too high with the roll full. With the armature current held constant, the larger these mechanical losses are in relation to the power required to provide tension, the more the tension will vary from the required value, so that when deciding on the maximum tension requirements, values in excess of those actually required should not be selected.

A procedure was outlined by Mr. Smith for making tests and securing data on power input and speed in order to calculate tension. Although the assumptions are not strictly accurate because of variation in motor losses they are sufficiently accurate for all practical purposes. The author described, by example, the method of making the necessary calculations.

Temperature Measurement

"Temperature Measurement and Control in the Rubber and Plastics Industries," by F. L. Spangler (Leeds & Northrup), was the title of another paper presented at the conference. This paper described the application of the proportional control principle to the regulation of temperature of electrically-heated molds for rubber and plastics.

Temperature in the molding process is influenced by various heat transfer lags in the machine. One lag is caused by the fact that the temperature detector is not located in the molding material but is in the metal body of the machine or mold so that appreciable time is required for any change in temperature to reach the detector, Mr. Spangler noted. Another lag is due to the fact that the heater itself takes appreciable time to come to temperature after the power has been turned on.

These and other lags cause temperature to "cycle" about the desired point when on-off control is used. Proportional control, on the other hand, is able to compensate for all lags and provides accurate straight-line regulation of molding temperature. The importance of this type of temperature control is evident when one considers that successful molding depends on the control of three factors—time, pressure and temperature.

Control of temperature, however, is the most difficult of the three and possibly for that reason has been the least investigated. It offers the greatest potential improvement in production and quality. Mr. Spangler outlined and illustrated various molding processes showing application of electrical resistance heating in each case.

Various temperature control systems were then discussed, including the potentiometer, the Wheatstone bridge, and a Duration-Adjusting Type (D.A.T.) proportioning control. With this system, proportional action is obtained by regulating the ratio of "power on" time to "power off" time, as a function of how far and how long temperature is away from the control point. The controller turns power on and off through a contactor switch, and operates rapidly enough to prevent any appreciable change in machine temperature. Heat input is supplied exactly as needed to maintain temperature regardless of load and voltage changes.

C. E. Robinson (Reliance Electric & Engineering Co.), also presented a paper at the conference. The title of his paper was "Spot Conversion for Rubber and Plastics Manufacturing Plants."

Borden Forms Chemical Division

The formation of a Chemical Division to take over the activities of the Casein Co. of America and Durite Plastics, both wholly-owned subsidiaries, has been announced by the Borden Co. William F. Leicester, vice-president of the parent company, will head the new division. Both the Casco and Durite trade names will be retained. Headquarters of the Chemical Division will be maintained in New York City, with administrative offices at Philadelphia and Seattle.

CHANGES OF PERSONNEL IN TECHNICAL DEPARTMENTS AT GENERAL TIRE

F. Theiss L. Baker W. Hoelzer

Three changes of personnel in technical departments at the General Tire & Rubber Co., Akron, Ohio, have been announced by A. W. Phillips, general manager of manufacturing. Fred Theiss has been named manager of technical service of the Akron plant. Lawrence Baker has been appointed manager of product compounding for all of General's plants both in this country and abroad. William Hoelzer has replaced Mr. Baker as manager of domestic plant technical service.

All three men are graduates of the University of Akron. Mr. Theiss and Mr. Baker are members of the American Chemical Society. Mr. Theiss has been with General for 14 years, and was chief chemist before his new appointment. Mr. Baker was associated with the Mansfield Tire & Rubber Co. before joining General last fall.

Mr. Hoelzer was formerly associated with the Pennsylvania Rubber Co., a General subsidiary, for 19 years, as development manager. He is a member of the Tire and Rim Association, and has been on the Federal Tire and Tube Specifications Committee for 15 years. For 10 years he was on the board of trustees of the association.

Latex Imports Increasing

Imports of latex in the first quarter of the current year amounted to 9,374 long tons, highest quarterly receipts since imports of rubber in this form began several years ago, according to a report recently issued by Commodity Exchange, Inc., New York City. Latex imports in the first quarter of 1946 amounted to 1,073 long tons, and in the first quarter of 1947 to 2,955 long tons. Consumption of latex by the American rubber manufacturing industry in the first quarter of 1948 was 6,052 long tons, dry weight equivalent, compared with 2,104 long tons in the first quarter of last year. Manufacturers say the number of products made directly from liquid rubber latex has been expanding rapidly since the war but most of the increased tonnage of latex imports goes into "foam rubber," as an improved substitute for feathers and felt in mattresses, furniture, automobile upholstery and cushions.

Jefferson Plant in Operation

Jefferson Chemical Co., Inc., has announced that its plant near Port Neches, Texas, is now in full commercial operation. The plant manufactures ethylene glycol, ethylene oxide, ethylene dichloride, and other products. Formed in November, 1944, by the Texas Co. and the American Cyanamid Co., Jefferson Chemical operates as an independent organization, with its own technical and research, engineering, sales, accounting and general administrative departments.

Kahn Organizes Own Company

Gilbert B. Kahn, for many years associated with the Consolidated Products Co., and well known in the chemical and allied industries, has set up his own organization for buying, selling, appraising, and liquidating machinery, equipment and complete plants in those fields. Offices and facilities of the new organization are located at 75 West St., New York 6, N. Y. A practical engineer with 20 years of experience in buying and selling used chemical and process equipment, Mr. Kahn and his associates will serve these industries, and finance deals involving one machine to complete operating plants. Mr. Kahn has also announced plans to set up an export department.

Versalite Plastic Material

A unique thermoplastic material, called Versalite, that is tough, light in weight, and easy to form into compound shapes, is now being manufactured by the U. S. Rubber Co. It is said to be non-corrosive and stable under changing atmospheric conditions, with exceptional insulating properties and a low rate of heat conductivity. The company controls the making of the thermoplastic material from base resin to finished form product, manufacturing the base resin, compounding and fabricating. Future planned applications include luggage, radio cases, and component parts of automobiles, airplanes, boats and trains.

Reports on German Technology

A new series of comprehensive BIOS Overall Reports on German technology is being made available to American businessmen by Great Britain. The reports are based on information obtained by American and Britsih industrial intelligence specialists of the British Intelligence Objectives Sub-Committee (BIOS), and are surveys of individual German industries. They have been compiled with the object of comparing the state of development of British and German industries, thus providing a standard reference to the outstanding German achievements. The first report, covering the German petroleum and synthetic oil industry, is available. Other reports, including those covering the German rubber industry and the plastics and resins industry, will be issued at a later date. Printed copies of BIOS Overall Reports are available from the British Information Services, 30 Rockefeller Plaza, New York 20, N. Y., at $3.00 each. The sales section of the British Information Services will furnish detailed synopses of the overall reports on request.

Ontario and Buffalo Meet

The Ontario and Buffalo Rubber Groups held a joint meeting on May 7 at the Hotel General Brock, Niagara Falls, Ontario, with approximately 90 members and guests in attendance. A colored sound moving picture showing the building of a tire at the Firestone Tire & Rubber Co. was presented. In addition to factory equipment, the picture offered animated sketches showing individual operations and their functions in the production of a finished tire. A second picture depicting the part taken by the Dunlop Rubber Co., Ltd., during the war was also shown. This picture viewed the factory production of various items, and as far as practical the actual usage of these items in the war.

Chicago Plans Golf Outing

The 1948 Golf Outing of the Chicago Rubber Group will be held at the Acacia Country Club, Chicago, Ill., on July 17, 1948. In addition to the usual features, the committee has several novelty surprises in store for both golf participants and those who come just for the outing. Golf will start at 9:00 A.M. and dinner will be served at 7:00 P.M. This year's golf outing committee includes: *Chairman,* Maurice O'Connor (C. P. Hall Co.); *Co-Chairman,* Dwight Smith (Intland Rubber); and John Gallagher (Allis Rubber), Bob Campbell (N. J. Zinc), Ed Meyer (Herron & Meyer), and Charles Skuza (Inland Rubber).

Buffalo Plans Summer Outing

The annual summer outing of the Buffalo Rubber Group will be held at the Lancaster Country Club, Buffalo, New York, on July 31. The outing will feature a steak dinner, and various games, including golf. Prizes will be awarded winners of the different events.

Rubber in the Arctic

According to newspaper reports, Russia is now growing "rubber beets" in the Arctic tundras of Siberia, particularly in the region of Yamalonets. The "rubber beet" is said to have been obtained by crossing kok-saghyz with an Arctic plant. The same reports indicate that a Tasmanian rubber-producing plant has been successfully grown in peat bogs near Marieholm in the Swedish province of Smaaland.

German Zinc Dust Report

German laboratory methods for producing electrolytic zinc dust, a material used in manufacturing butadiene for synthetic rubber and in preparing reducing agents for the dye industry, are described in a publication recently issued by the U. S. Bureau of Mines. Included in the report, which is based on research at the Ludwigshafen laboratory of I. G. Farbenindustrie, are discussions of the electrolyte, anodes and cathodes, construction details of a commercial apparatus, and a comparison of the physical and chemical properties of electrolytic and smelter zinc dusts. Free copies of the report, Information Circular 7466, "Electrolytic Preparation of Zinc Dust," may be obtained from the Bureau of Mines, Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Penna.

Correct Tire Pressure Campaign

In an effort to improve existing unsatisfactory tire inflation conditions the Rubber Manufacturers Association has launched a "Correct Tire Pressure" campaign. The basis of the campaign is a two-color display chart containing the correct tire inflation pressures for all makes and models of automobiles as recommended for original equipment tires by the automobile manufacturers and the Association. Through the cooperation of tire manufacturers and leading inflation equipment producers this poster is being brought to the attention of car owners, service station attendants and tire dealers with the idea of assisting them in determining and using correct tire inflation pressures.

New Bremen Expands Facilities

The New Bremen Rubber Co. has started construction of an addition to its factory in New Bremen, Ohio. The building, 40 x 120 feet, will add 1300 square feet of floor space to the present facilities. Company officials stated that the addition will employ from 50 to 75 workers over the approximately 130 which the company presently employs. New Bremen manufactures rubber gloves for home and industrial use, baby panties, and dolls and toys of various types. The company is a subsidiary of Seiberling Latex Products Corp. of Barberton, Ohio.

Offer Surplus Black Plant

The War Assets Administration on June 3, asked for bids for the purchase or lease of a Government surplus channel black carbon plant near Monument, New Mexico. The plant is the last of six declared surplus to WAA, the other five already having been disposed of. Sealed bids will be received by the WAA Office of Real Property Disposal, Temporary Building 1, Washington, D. C., until 3:00 P.M. (EDST), July 1, 1948, when they will be publicly opened. The plant consists of a 340 acre land site, two burner units of 40 burner houses each, and two unassembled burner units with most of the material for 32 burner houses more. It is designed for a capacity of 15,200,000 pounds of carbon black per year. The plant is operated at present under a lease cancellable on 30 days' notice. Permits for the use of natural gas in making carbon black are issued by the Oil Conservation Commission of the State of New Mexico. Prospective purchasers or lessees, WAA said, should make their own arrangements for gas supplies.

Kralite Plastic Cutting Block

The United States Rubber Co. has announced the development of a new plastic cutting block which is said to have the strength of wood but will not split under the blows of a lumberjack's axe. The plastic, made of thermoplastic resins blended with synthetic rubber, is called "Kralite," and can be molded in any color or shape and in various degrees of hardness. The cutting block is used on a guillotine-like machine fitted with steel dies to cut shoes, handbags, clothing and other products out of leather, fabric and paper. The new plastic block has no grain and will not chip or split under the impact of cutting dies, according to company officials.

Quebec Sees Golfing Films

The final scheduled meeting of the current season was held by the Quebec Rubber and Plastics Group at Legion Hall in Montreal, Que., on May 13. The meeting featured the showing of two films on golf. A professional golfer from one of Montreal's clubs addressed the group on the finer points of the game. The annual golf tournament is scheduled to take place on June 25 at the Granby Golf Club, Granby, Que. A business meeting relative to the preparation of a slate of officers for the next season will take place shortly.

Washington Adopts Constitution

The Washington Rubber Group formally adopted a constitution at its third regular meeting held on May 18 at Temporary Building 3, Navy Department, Washington, D. C. The group also viewed a film presented by the Goodyear Tire & Rubber Co., depicting the manufacture of synthetic rubber. The next meeting of the group is scheduled for June 18, at which time a talk will be given on "The Psychology of Humor."

CHICAGO ELECTS OFFICERS AND HEARS FIELD ON POLYBLENDS

Approximately 110 members and guests attended the May 7 meeting of the Chicago Rubber Group, held at the Morrison Hotel, Chicago, Ill. Principal speaker of the evening was George E. Field, Technical Service Engineer of the B. F. Goodrich Chemical Co., Cleveland, Ohio. The title of Mr. Field's paper was "Processing and Physical Properties of Geon Polyblends."

The following members of the Chicago Group were elected as Officers for the 1948-1949 season at the meeting: *Chairman,* Robert C. Dale (Inland Rubber); *Vice-Chairman,* W. H. Peterson (Enjay); *Secretary-Treasurer,* Ray M. Penner (W. H. Salisbury). Members elected to the Executive Committee include: Sam Armato (Witco), Robert E. Elliott (Standard Oil-Indiana), Doug P. Johnstone, Al Meyer (Herron-Meyer), M. O'Connor (C. P. Hall), A. G. Susie (Marbon), Herman Boxser (Western Felt Works), B. Benson (Inland Rubber), R. H. Barbour (Chicago Rawhide), V. Le Brecque (Victor Mfg.), D. Smith (Inland Rubber), and Charles Wonder (Van Cleef). Members nominated for Director of the Division of Rubber Chemistry, ACS, include: Dr. H. A. Winkelmann (Dryden) and Paul F. Niessen.

Emphasizes Unique Properties

In his address, Mr. Field stated that Geon Polyblend has many unique and useful properties, and is engineered to fill the need in the plastics industry for a thermoplastic containing a non-migrating, non-volatile plasticizer. Further, Geon Polyblend offers many advantages over the conventional mill-mixed nitrile-vinyl blends due to improved processing properties. The unique properties of Polyblend result from the colloidal blending of Hycar nitrile rubber and Geon polyvinyl chloride resin.

After discussing the differences in processing properties of Polyblend and various mill-mixed blends, Mr. Field devoted the remainder of his talk to a comparison of the physical properties of Geon Polyblend and liquid plasticized vinyls. To this end, Mr. Field illustrated his talk with different charts and tables which served to emphasize the comparisons presented.

These illustrated the non-volatile properties of the Hycar plasticizer as compared to tri-cresyl phosphate in Geon 101 compound; the non-extractable property of Geon Polyblend; the non-migrating properties of the Hycar type plasticizer used in Geon Polyblend; the effect of additional plasticizer on tensile, modulus and elongation; and the effect of additional plasticizer on hardness and crescent and rectilinear tear.

Also, the effect of loading on crescent tear both at constant plasticizer content and with plasticizer varied to maintain hardness constant at 85 "A"; the effect of loading on rectilinear tear; the effect of loading on abrasion resistance; and where the plasticizer has been required to maintain a constant hardness of 85 "A" as the loading is increased.

In conclusion, Mr. Field stated that Geon Polyblend represents a new tool which has been made available to the rubber and plastics industry to help them solve ever present problems. Polyblend is so versatile, he stated, that it has yet to be confined to a limited area of applications. New uses in new fields are being developed every day. Its ultimate potential is still unknown, he stated.

Southern Ohio Holds Outing

Approximately 80 members and guests attended the annual outing of the Southern Ohio Rubber Group held on May 15 at Edelweiss Park, Dayton, Ohio. A golf session was held at the Troy Country Club, Troy, Ohio, in the morning. Nine holes were played in a heavy rain, and the second nine holes on a wet, soggy course.

Golf prizes were won by the following members: Ralph Wolf (Harwick Standard), Bill Whittaker (Herron Bros.), Bob Radow (Dayton), Roy Marston (Binney & Smith), Bob Sucher (Inland Mfg.), Bob Anthiel (Inland Mfg.), Fred Rohel, Bob Emmett (Binney & Smith), Russ Longanecker (Dayton), Don Simonds (Cabot), Jack Jones (Inland Mfg.), Frank Woznak (Irvington Varnish), Jack Feldman (Inland Mfg.), Johnnie Lucid (Inland Mfg.), Paul MacPhee (National Cash Register), Ray Ritzert (Dayton), Harold Weese (Inland Mfg.), and Bob Feldhaus.

The picnic session held at Edelweiss Park in the afternoon featured baseball and volley-ball games. The following members won door prizes: Roy Smith (Gro-Cord Rubber), Frank Woznak, Harold Weese, Don Neu (Inland Mfg.), Bud Dill (Inland Mfg.), Ed Kremer (Dayton), Bob Antheil, Jack Feldman (Inland Mfg.), John Poffenberger (Cincinnati Rubber), Paul MacPhee, Bob Radow, Mark Deal (Inland Mfg.), Rog Hickernell (Inland Mfg.), and Dayle Buchanan (Inland Mfg.).

Ray Ritzert (Dayton) was general chairman of the outing, assisted by the following picnic committee: Phil Berner (Inland Mfg.), Dan Doherty (Herron Bros.), Sam Brandenburg (Plastic & Rubber Prod.), and Dan Meyer (Dayton). L. J. Keyes (Dayton) was chairman of the golf session.

NORTHERN CALIFORNIA HEARS HOLLISTER ON NITRILE RUBBERS

Approximately 35 members and guests attended the May 27 meeting of the Northern California Rubber Group held at the Claremont Hotel, Berkeley, Calif. Principal speaker of the evening was Joseph W. Hollister of the Rubber Laboratory, Mare Island Naval Shipyard, Vallejo, Calif. The subject of Mr. Hollister's address was "Evaluation of Nitrile Rubbers for High Temperature Gasket Service."

The speaker reported on attempts to determine the relative suitabilities of commercially available nitrile rubbers for high temperature gasket service at the Mare Island laboratories. Mr. Hollister said that Silastic was included in the comparison since this material is reputed to be excellent for this purpose. Retention in sealing pressure after aging at 300° F. was the principal criterion used. Changes in hardness and tensile properties were also noted, he said.

No clear correlation was found between acrylic nitrile content of the rubbers and retention of sealing pressure, hardness and tensile properties with aging, although medium acrylic nitrile content seemed to favor retention of sealing pressure, the speaker stated. High acrylic nitrile content seemed to favor retention of hardness and tensile properties.

Mr. Hollister stated the investigation indicated that Silastic seemed to be no better than certain of the nitrile rubbers for service equivalent to 70 hours at 300° F., but it gave indication of being better if the service were more severe.

At the business session of the meeting, Herman Jordan (DuPont) read the history of the group which he prepared and which will be submitted to the Rubber Division for publication in *Rubber Chemistry and Technology.* The summer outing this year will be held at Curry Creek Park, Oakland, Calif., on August 15. The next meeting of the group will be held on June 24 at the Hotel Claremont in Berkeley.

Connecticut Group Hears Northam

Approximately 90 members and guests attended the May 14 meeting of the Connecticut Rubber Group, held in the auditorium of the United Illumination Co., in New Haven, Conn. Principal speaker of the evening was A. J. Northam of the Rubber Chemicals Division of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., who spoke on "Color Matching Rubber." The speaker stated that the factors affecting color in rubber were compounding ingredients, including grades of rubber used, amount of combined sulfur, type of accelerators and antioxidants, and fillers. Various methods of curing, such as press, open steam, dry heat, sulfur chloride or ammonia, will affect the color of the rubber, Mr. Northam stated. The speaker noted that color may be accurately measured by the recording spectrophotometer. At the business session of the meeting, plans for the annual summer outing to be held on August 14 were discussed.

Dinsmore Addresses Thiokol Club

Dr. R. P. Dinsmore, vice-president of the Goodyear Tire & Rubber Co., was the principal speaker at a meeting of the Thiokol Technical Club held on May 20 at the Thiokol Laboratories in Trenton, N. J. Introduced by J. W. Crosby, president of the Thiokol Corp., Dr. Dinsmore discussed various aspects of the over-all rubber industry under the general title of "Snapshots of the Rubber Industry."

Showing a number of charts depicting the consumption and price trends of natural rubber, the speaker covered the competitive position of natural and synthetic rubber. He stated that on an equal price basis, synthetic rubber would account for at least 10% of total consumption, but in order to account for a greater proportion of such consumption synthetic rubber needs a price advantage ranging between 20 to 30 percent. These figures, it was emphasized, apply to a so-called "normal" rubber market.

Dr. Dinsmore also discussed the strides made in the processing of synthetic rubber since 1942, and the improvements in physical properties of the various copolymers. Referring to the failure of the German buna rubber, he declared that in his opinion buna tires failed not only because the buna being made was exceptionally tough, but because of the poor quality of the fabrics the German tire manufacturers were forced to use. Data on the tire rolling resistance of natural rubber tires and natural-synthetic tires was also given by the speaker.

Promote Use of Latex Foam

Encouraged by a nationwide survey which indicated that latex foam may well become the principal cushioning material of the future, the rubber producing industry is about to embark upon a special promotion of latex foam. The prime objective of the campaign will be to educate the trade and the public to the nature of this material and to its application in various fields. The campaign will be organized under the aegis of the British Rubber Development Board, which, early in 1947 established the Rubber Development Bureau, with offices at 1631 K St., N.W., Washington, D. C. The purpose of the Bureau is to expand the U. S. market for rubber by publicizing new developments in this field.

Introduces PDA-20 Antioxidant

The addition of PDA-20 to its line of poly diaryl amine antioxidants has been announced by the Benson Process Engineering Co., Eden, N. Y. According to Benson Process, the new antioxidant is superior to many other antioxidants currently on the market, particularly in the matter of oxygen aging, the ultimate tensile of aged specimens indicating an advantage of 12 to 15 percent in some cases. The company also states that PDA-20 is the most fluid antioxidant currently available and that it handles easily at room temperature.

Coming Events

June 23-25. Second Rubber Technology Conference, London, England. (Auspices of Institution of the Rubber Industry.)
June 24. R. I. Rubber Club. Outing. Pawtucket Golf Club, Pawtucket, R. I.
June 24. Northern California Rubber Group.
June 25. Detroit Rubber & Plastics Group, Outing, Forest Lake Country Club, Detroit, Mich.
June 26. New York Rubber Group. Outing. Doerr's Grove, Millburn, N. J.
July 17. Chicago Rubber Group, Golf Outing, Acacia Country Club, Chicago, Ill.
July 22-23. Rubber Division, A.C.S. Summer Meeting, Hotel Mayfair, Los Angeles, Calif.
July 24-25. Los Angeles Rubber Group. Outing, Catalina Island, Calif.
July 31. Buffalo Rubber Group, Outing, Lancaster Country Club, Buffalo, N. Y.
Aug. 24. New York Rubber Group. Golf Tournament, Winged Foot Golf Club, Mamaroneck, N. Y.
Sept. 10. Detroit Rubber & Plastics Group, Detroit-Leland Hotel, Detroit, Mich. (Tentative).
Sept. 17. Southern Ohio Rubber Group. Dayton, Ohio. (Tentative).
Sept. 21. Buffalo Rubber Group, Westbrook Hotel, Buffalo, N. Y.
Sept. 24. Boston Rubber Group, Somerset Hotel, Boston.
Sept. 30. Northern California Rubber Group.
Oct. 1. Detroit Rubber Group. (Tentative).
Oct. 5. Los Angeles Rubber Group, Mayfair Hotel, Los Angeles, Cal.
Oct. 15. New York Rubber Group, New York, N. Y.
Oct. 19. Buffalo Rubber Group, Westbrook Hotel, Buffalo, N. Y.
Oct 28. Northern California Rubber Group.
Nov. 8-10. Rubber Division, A.C.S., Fall Meeting, Book-Cadillac Hotel, Detroit, Mich.
Nov. 18. R. I. Rubber Club, Crown Hotel, Providence, R. I.
Nov. 18. Northern California Rubber Group.
Dec. 7. Los Angeles Rubber Group. Xmas Party.
Dec. 9. Southern Ohio Rubber Group, Xmas Party, Miami Valley Country Club, Dayton, Ohio.
Dec. 10. New York Rubber Group, Xmas Party, New York, N. Y.
Dec. 10. Detroit Rubber & Plastics Group, Xmas Party, Detroit-Leland Hotel, Detroit, Mich.
Dec. 14. Buffalo Rubber Group, Xmas Party, Westbrook Hotel, Buffalo, N. Y.
Dec. 17. Boston Rubber Group, Somerset Hotel, Boston.

Hewitt Latex Foam Mattress

A new, odorless latex foam mattress, containing 100 per cent pure, natural latex, will soon move off the production lines of the Hewitt Restfoam Division of Hewitt-Robins, Inc., Buffalo, N. Y. The new mattress, a product of the Hewitt Comfort Institute, is being offered direct to retail stores, according to company officials.

Revise Packing Specifications

According to the Rubber Manufacturers Association, the shortage of suitable materials for packaging natural rubber in eastern producing areas continues and latest reports are that it is not possible for the producers to pack all grades of rubber in accordance with the standard Packing Specifications for Crude Rubber of the Association dated August 1, 1938. In view of these conditions, the Association, with the endorsement of the Rubber Trade Association of New York, adopted Temporary Packing Specifications for natural rubber effective July 1, 1947, designed to cover the period during which suitable packing and marking materials are in short supply. These Temporary Packing Specifications have now been amended by the Crude Rubber Committee of the Association with the endorsement of the R.T.A. in an attempt to improve packing and marking. The amended specifications are to become effective at the earliest possible date, but not later than September 1, 1948. A copy of the amended specifications may be secured from the Rubber Manufacturers Association, 444 Madison Ave., New York 22, N. Y.

Firestone Grants Wage Increase

The first wage settlement among the Big Four of the rubber industry was made on June 12 when the Firestone Tire & Rubber Co. agreed to pay its 23,000-odd employees an increase of 11 cents an hour. Earlier, on June 6, the negotiations between the B. F. Goodrich Co. and the rubber union on the wage question were abruptly broken off and the Goodrich local planned to take a strike vote on June 16. The Firestone agreement, however, which runs for two years but contains a proviso permitting reopening of the wage clause after next April 14, is expected to set a pattern for the entire rubber industry. The agreement, unlike those recently granted by the automotive industry, calls for a straight hourly increase and does not include an escalator clause with a cost-of-living formula as does the General Motors contract. The 11-cent-an-hour increase is expected to add approximately $4,762,000 to Firestone's annual payroll, and increases average earnings of about 12,500 Akron plant workers from $1.62 to $1.73 an hour. (Later: Goodyear granted an 11 cent-an-hour increase to its 28,000 employees on June 17).

Pool Rare Bibliographies

Numerous rare and unpublished bibliographies on scientific and technical subjects are now available to industry as a result of the formation of a pool of unpublished bibliographies by the Special Libraries Association, housed at Battelle Memorial Institute, Columbus, Ohio. The phases of technology represented by the bibliographies are highly diversified. Persons interested in obtaining a complete listing of the bibliographies may write to Ralph H. Hopp, technical librarian of the Battelle Library, who serves as chairman of the SLA Bibliography Committee.

BLACK PRODUCTION INCREASES QUARTERLY FIGURES INDICATE

In the first quarter of 1948 production of carbon black averaged 3,622,500 pounds daily, compared with 3,555,600 pounds in the first quarter of 1947, according to a report issued by the U. S. Bureau of Mines. Shipments in the same 1948 period averaged only 3,520,400 pounds daily compared with 4,050,000 pounds in the first quarter of 1947, owing to the reduced demand for furnace blacks. Total quarterly figures follow:

In the first quarter of 1948, 168,973,000 pounds of channel type were produced, and 160,676,000 pounds of furnace type were produced, for a total of 329,649,000 pounds. This compares with 159,242,000 pounds of channel type and 160,762,000 pounds of furnace type for a total of 320,004,000 pounds of carbon black produced in the first quarter of 1947.

Shipments of carbon black in the first quarter of 1948 totalled 320,362,000 pounds, of which 170,007,000 pounds were of the channel type, and 150,355,000 were furnace type. This compares with a total of 364,497,000 pounds of carbon black shipped in the first quarter of 1947, of which 166,751,000 pounds were channel type, and 197,746,000 were furnace type.

Producers' stocks at the end of the first quarter of 1948 amounted to 81,691,000 pounds of carbon black. Of this figure, 5,922,000 pounds were of the channel type, while 75,769,000 were of the furnace type. This compares with a total of 31,735,000 pounds of carbon black in producers' stocks at the end of the first quarter of 1947, of which 9,497,000 pounds were channel, and 22,238,000 were furnace type.

Appointments At Armstrong Cork

The Armstrong Cork Co., Lancaster, Penna., has announced several new appointments and changes in personnel. Richard Almy has been appointed manager of floor products research; Bruce R. Billmeyer manager of industrial products research, and Thomas W. Elkin, Jr., manager of the rubber section. James T. Bergen has been named manager of a newly created mechanical research section. Dr. C. C. Vogt has retired as manager of chemical research and has been succeeded by Dr. Ernest J. Pieper, manager of floor products research for the company since 1938.

Taunton Coating Liquidates

After 90 years of continuous operation, the Taunton Coating Mills, Inc., manufacturers of coated fabrics of Taunton, Mass., ceased manufacturing operations on May 31. The liquidation of the company was attributed to the current tax and labor situations as well as to the fact that the development of unsupported plastic film and the high price of cotton gray goods made further operation impossible. Much of the machinery and some of the company buildings have already been sold. Final shipments were made during the latter part of May and early June.

Phenol Production Expanding

A yearly production of 400,000,000 pounds of phenol or carbolic acid, twice the wartime peak, will soon be achieved because of its expanding use in plastics and synthetic rubber, according to Dr. Paul O. Powers of the Battelle Memorial Institute in a talk on "The Chemistry of Phenolic Resins" given on May 22 at Columbus, Ohio. The chemistry of phenol-formaldehyde resins is still not completely understood, said Dr. Powers, but recent research, particularly in Europe, has led to new theories of resin formation and to greater use of phenol-formaldehyde resins in plastics.

Celebrates 100th Anniversary

Watson-Stillman Co., Roselle, N. J., producers of rubber machinery and equipment, recently celebrated its 100th anniversary. Addressing a management group of the organization, Edwin A. Stillman, president of the company, predicted a growing demand for production machinery, particularly in the rubber and plastics industries, for which his company is a chief supplier of hydraulic equipment. Mr. Stillman briefly outlined the company's 100 years of development. Founded in the year 1848, the company has continued uninterrupted under management by direct descendants of the original founder.

COMPARISON OF ACCIDENT FREQUENCY AND ACCIDENT SEVERITY IN 1946

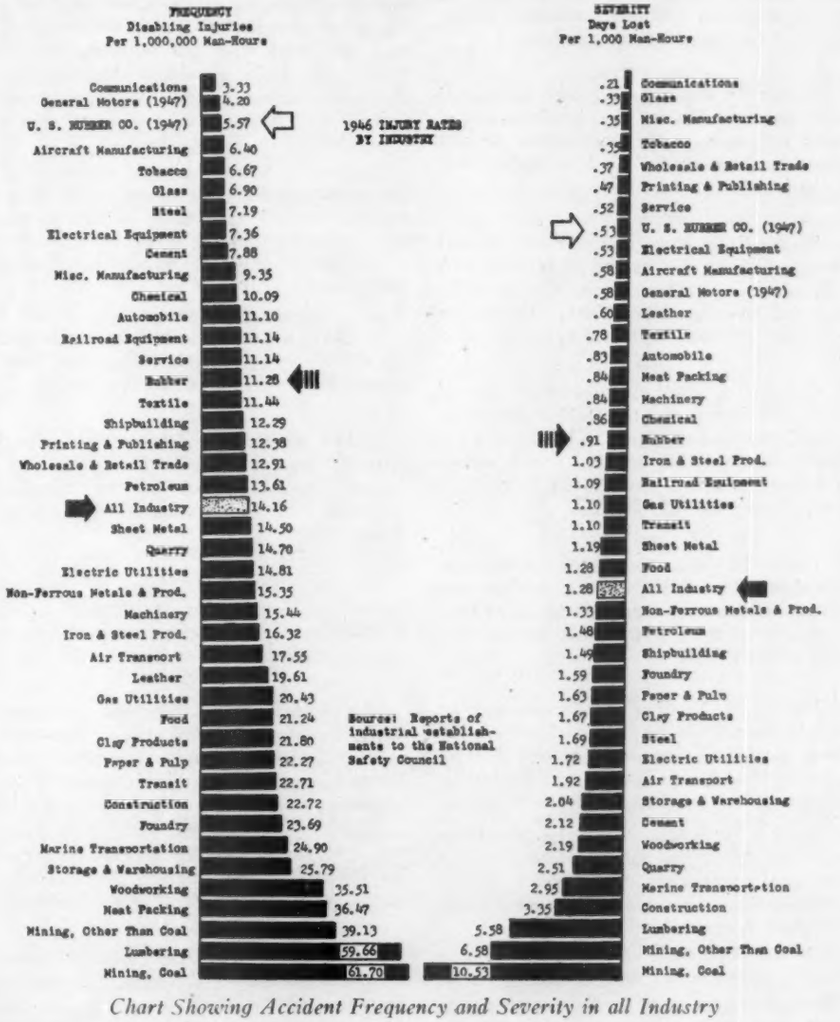


Chart Showing Accident Frequency and Severity in all Industry

Accident frequency and accident severity of all industries in 1946 is shown on the chart above. It will be noted that the rates for the rubber industry (broken arrow) are much better than those for all industry (solid arrow). The chart shows U. S. Rubber Company's 1947 position (open arrow) in relation to the 1946 positions of other industries because nation-wide figures are not available for 1947. The experience of the U. S. Rubber Co. includes all industrial accidents resulting in one or more days lost and all industrial injuries where no time was lost but specific awards were made for permanent partial disabilities. The data reported also includes all hernia cases (a total of 54).

NAMES IN THE NEWS

CHARLES R. INCE, associated with the St. Joseph Lead Co. since 1929, has been appointed sales manager of the company, succeeding IRWIN H. CORNELL, who has retired after 38 years of service.

WILLIAM D. WILSON, formerly associated with the McCormick Rubber Co., Ridgefield Park, N. J., has been named district sales representative in Northern New Jersey and New York City for the Special Chemicals Division of the Pennsylvania Salt Manufacturing Co.

ROBERT MORAN, associated with the General Tire & Rubber Co. for the past 12 years, has been appointed manager of industrial tire sales of the company.

HARRY W. BROWN, since 1937 associated with the U. S. Rubber Co., has been named sales manager of the automotive department, succeeding S. E. ABRAMSON, who retired after 51 years of service.

A. W. CARPENTER, manager of physical testing laboratories of the B. F. Goodrich Co. plant in Akron, Ohio, was recently married to Miss Irma Coon, Department of State secretary in Washington, D. C.

CLEMEN J. EHRLICH, formerly counsel and sales director of the Rubber and Plastics Compound Co., Inc., New York City, has announced the opening of new offices for the practice of law at 475 Fifth Avenue, New York 17, N. Y.

JAMES M. HUGHES, associated with the Goodyear Tire & Rubber Co. for the past 12 years, has been appointed assistant sales manager of the Pennsylvania Rubber Co., Jeannette, Penna.

JOSEPH M. WAFER, geenral manager of the Industrial Chemical Sales Division, has been elected a vice-president and director of the West Virginia Pulp and Paper Co.

L. A. WOERNER, formerly associated with the Goodyear Tire & Rubber Co. as technical coordinator, has joined the Surety Rubber Co. as general manager in charge of plant operations.

C. LAWRENCE MUNCH, president of the Hood Rubber Co., a B. F. Goodrich division, has been elected chairman of the Chamber of Commerce of Boston, Mass.

ARTHUR R. BROADMAN, associated with the Heyden Chemical Corp., New York, since 1939, has been elected a vice-president of that company.

CARL BROCKWAY, associated with the Thermoid Co. since 1941, has been elected a vice-president of the company.

New Scrap Rubber Officers

J. J. Costello, of Tanney-Costello, Inc., Akron, was recently elected president of the Scrap Rubber Institute. Victor Rozen, of Triple Cities Rubber Co., Binghamton, N. Y., was elected vice-president, and George W. Reid, secretary-treasurer. Members of the Executive Committee include Nat E. Berzen, J. H. Desser, Robert Feinburg, Simon Greenfield, Henry Rose, Joseph M. Viener, and George Woloch. The Scrap Rubber Institute is a unit of the National Association of Waste Material Dealers, Inc.

CHARLES W. MACKETT, formerly assistant sales manager of the mechanical rubber goods division of Hewitt-Robins, Inc., and associated with the company for 32 years, has been appointed Manager of Sales Operations, a newly established position.

ROBERT L. SIBLEY, general manager of the rubber service department at the Monsanto Chemical Co. plant in Nitro, Va., has received an honorary degree of Doctor of Science from Clark University, Worcester, Mass.

B. H. MACLEOD, general sales manager of the Gro-Cord Rubber Co., has been elected a vice-president of the company.

HARRY J. MILLER, formerly associated with the Goodyear Tire & Rubber Co., has joined the sales staff of the Stauffer Chemical Co. His headquarters will be in Akron, Ohio.

WILLIS J. STILLWELL, formerly assistant to the president of the Irvington Varnish & Insulator Co., has been appointed a vice-president of the firm.

MALVERN J. HILER, formerly associated with the Stepan Chemical Co., has been appointed vice-president in charge of customer relations for the Commonwealth Engineering Co.

J. E. CARTER, formerly federal tax counsel for the B. F. Goodrich Co., has been named assistant secretary of the company.

WILLIAM C. ARTHUR, formerly president and a director of Talon, Inc., and an executive of the B. F. Goodrich Co., has been elected president of the Eberhard Faber Pencil Co., succeeding JAMES C. MUSSER, who has been elected chairman of the board.

SIMON COLLIER, Director of Quality Control for Johns-Manville Corp., was recently inducted into the Johns-Manville Quarter Century Club, a company organization honoring those with 25 years active service with the company.

Crocker Joins General Latex

E. Charlton Crocker

E. Charlton Crocker has joined the staff of the General Latex & Chemical Corp., Cambridge, Mass., compounders of natural and synthetic rubber latices. Mr. Crocker is a chemical engineering graduate of the Massachusetts Institute of Technology. He served as a liaison officer between the research staff of the Office of Strategic Services and the British War Office during World War II. He has subsequently been a member of the chemical engineering staff of Arthur D. Little, Inc., and has also been associated as a chemical engineer with Overseas Consultants, Inc., who served as special consultants to the Secretary of the Army.

Retires From National Lead

Ivan D. Hagar, vice-president of the Titanium Pigment Corp., and assistant manager of the titanium division of the National Lead Co., has retired after 27 years with National Lead. He will continue his affiliations with the company in a consulting capacity. Mr. Hagar joined the Titanium Pigment Co. in 1921 as a salesman. He became eastern sales manager in 1931 and in 1936 was elected to the board of directors. Five months later he was appointed eastern sales manager of National Lead's titanium division and was elected to the board of directors of the Titanium Pigment Corp. In July, 1937, he became vice-president of the Titanium Pigment Corp., and assistant manager of the titanium division.

To Help Direct Rubber Plan

John B. Ingle, who until three years ago was in charge of all Goodyear Tire & Rubber Co. activities in the Far East, will help direct the federal government's stockpiling program of crude rubber for defense purposes. Mr. Ingle will be associated with the Bureau of Federal Supply, a Treasury Department subdivision, which buys rubber and other strategic materials for stockpiling.

NEW POLYMERS AUTHORIZED BY OFFICE OF RUBBER RESERVE, RECONSTRUCTION FINANCE CORPORATION

Listed below are types and properties of new experimental GR-S polymers (including GR-S latices) which have been authorized by the Office of Rubber Reserve, Reconstruction Finance Corporation, since publication of those in our previous issue. Procedures for the distribution and sale of these polymers will be found in our October, 1945, issue. Normally, experimental polymers will be produced only at the request of the consumers and 20 bales (one bale weighs approximately 75 pounds) of the original run will be set aside if possible for distribution to other interested companies for their evaluation. The 20 bales when available will be distributed in quantities of one or two bales upon request to the Sales Division of Rubber Reserve or will be held for six months after the experimental polymer was produced unless otherwise consigned before that time. Subsequent production runs will be made if sufficient requests are received to warrant them.

X Number	*Manufacturing Plant*	*Date of Authorization*	*Polymer Description*	*Special Characteristics*
X-452 GR-S	Goodrich, Port Neches	5-11-48	GR-S stabilized with Stalite to be used as the standard reference test sample starting July 1, 1948.	Standard reference bale.
X-453 GR-S	Copolymer, Baton Rouge	5-11-48	Polybutadiene polymerized at 41° F and stabilized with BLE at 40 to 45 Mooney. Rosin soap emulsification used.	For low temperature service evaluation.
X-454 GR-S	Copolymer, Baton Rouge	5-11-48	A 90 butadiene-10 styrene monomer charge ratio GR-S with rosin soap emulsification polymerized at 41° F and stabilized with BLE at 40 to 45 Mooney.	For low temperature service evaluation.
X-455 GR-S	U. S. Rubber, Borger	4-21-48	A GR-S black masterbatch containing 66 parts of SRF black per 100 parts continuous GR-S-10 stabilized with 1.5 parts BLE at 54 ± 4 Mooney viscosity.	A GR-S black masterbatch for those consumers preferring rosin soap emulsified GR-S (GR-S-10).
X-456 GR-S	U. S. Rubber, Borger	4-21-48	A GR-S black masterbatch containing 50 parts of EPC black per 100 parts continuous GR-S-10 stabilized with 1.5 parts BLE at 54 ± 4 Mooney viscosity.	A GR-S black masterbatch for those consumers preferring rosin soap emulsified GR-S. Otherwise similar to GR-S Black 1 except for higher Mooney viscosity of contained polymer.
X-457 GR-S	U. S. Rubber, Borger	4-21-48	A GR-S black masterbatch containing 55 parts Philblack A per 100 parts GR-S type polymer stabilized with 1.5 parts BLE at 37 ± 4 Mooney viscosity.	
X-458 GR-S	U. S. Rubber, Borger	4-21-48	A GR-S black masterbatch containing 60 parts of Philblack O per 100 parts GR-S type polymer stabilized with 1.5 parts BLE at 37 ± 4 Mooney viscosity.	
X-459 GR-S	U. S. Rubber, Borger	5-7-48	A GR-S black masterbatch containing 50 parts EPC black per 100 parts GR-S type polymer polymerized at 41° F. Rosin soap emulsification used in contained polymer which is stabilized with 1½ parts BLE at 60 ± 5 Mooney.	
X-460 GR-S	Canadian Synthetic, Sarnia		Alum coagulated GR-S made in regular standard plant equipment with a shortstopped Mooney of 50 ± 4.	

NOTE: The following experimental and numbered GR-S polymers and GR-S latices were produced during April, 1948: EXPERIMENTAL GR-S POLYMERS—X-181-SP, X-274, X-278-SP, X-360, X-392-SP, X-385, X-410, X-415, X-416, X-419, X-422, X-427, X-430, X-434, X-435, X-439, X-443, X-448, X-457, and X-458. NUMBERED GR-S POLYMERS—GR-S, GR-S-AC, GR-S-SP, GR-S-10, GR-S-10-AC, GR-S-12AC, GR-S-20, GR-S-20-AC, GR-S-21, GR-S-25, GR-S-40-AC, GR-S-45-AC, GR-S-50, GR-S-60, GR-S-65-SP, GR-S-85-SP, GR-S Black 1, GR-S Black 2, and GR-S-Black-20. GR-S LATICES—GR-S Latex, Types II, III, IV, V, VI, VII and VIII, X-429-GR-S Latex, X-446 GR-S Latex, X-450 GR-S Latex, and X-451 GR-S Latex.

Anti-Static Plastic Surfaces

Glyco Products Co., Inc., Brooklyn, N. Y., reports that the incorporation of Acrawax C Powdered, one of its synthetic waxes, in plastics compositions results in anti-static surface properties and at the same time gives good anti-blocking action. Tests were conducted with vinyl copolymer molded products, using 1% or less of the wax in the compound, with satisfactory results. The material can be used on plastic sheeting and packaging films and on parts that are rubbed, touched or moving rapidly, as on shafts.

Purchases Surplus Black Plant

The Columbian Carbon Co., New York, N. Y., has purchased a war surplus carbon black plant at Seagraves, Texas, from the War Assets Administration. The purchase price was announced as $1,420,000 for the property, including the factory, gas desulphurizing plant and pipe line. Current annual capacity for the plant is 12,000,000 pounds of carbon black. Columbian plans to double the output as soon as possible. Gas will be supplied by the Wasson and Seminole oil fields under long-term contracts.

Seiberling-U.R.W. Sign Contract

The Seiberling Rubber Co., Akron, Ohio, signed a new contract agreement with the United Rubber Workers of America on May 17, and became one of the first of the major tire companies to come to terms. Only the wage question was left unsettled until an industry "pattern" is established. The new contract provides for paid holidays, check-off of union dues, and includes an arbitration clause. Local 18, U.R.W.A., ratified the proposed agreement on May 16, and it was signed by company and union officials on May 17.

Wilmington Chemical On Block

The assets and property of the Wilmington Chemical Corp., Wilmington, Del., will be offered for sale in one parcel on June 15, at the County Court House in Wilmington, King and Eleventh St. The company went into receivership on June 2. Assets and property include a chemical factory and equipment located on approximately 3½ acres at Third and Heald Streets, buildings and equipment located on approximately 6¼ acres at Commerce and Christiana Streets, and buildings and equipment located upon approximately 2/3 of an acre at Thirty-Second and Miller Road. The equipment is especially suited for oil processing or similar work. The plants include mixing and blending equipment, storage tanks, railroad siding, and everything necessary for immediate operation on a production basis. Copies of the order of sale and information concerning the assets offered for sale may be had at the office of the Receiver, F. William Carr, North American Bldg., Wilmington, Del.

Industrial Mobilization Planning

The Armed Services are proceeding slowly with their announced plans of industrial mobilization. A document entitled "Military Aspects of Industrial Mobilization," which covers the detailed and rather complicated operating procedures for allocation of private industrial capacity, has been prepared and can be secured by addressing a request to A. L. Miller, Chief, Procurement Planning Division, Munitions Board, The Pentagon, Washington, D. C. A list has been prepared of some 100 types of products having wide use in both civilian and military fields for which capacity will not be converted nor at this time allocated. This list includes such rubber products as pneumatic solid and cushion tires, inner tubes, aircraft hose, fire hose and tubing, belting, gaskets, etc. Among rubber products involved in allocation conversion surveys at present are hard rubber goods, coated fabrics, drug sundries, footwear, heels and soles, and sponge and latex foam goods.

Reduce Pliolite Resin Prices

The Plastics and Coatings Department of the Goodyear Tire & Rubber Co. has announced a substantial decrease in the price of its rubber reinforcing resins, Pliolite S-3 and S-6. The reduction, effective May 19, amounted to 5 cents per pound, with the same reduction holding for 50-50 masterbatches of these resins in natural or synthetic rubber stocks. Pliolite S-6, for example, now sells for 36 to 37 cents a pound, depending upon quantity.

Coaters Institute Changes Name

The association formerly called the Pyroxylin & Resin Coaters Institute, New York, has changed its name to the Plastic Coatings & Film Association. E. A. Claire of the Athol Mfg. Co. is president of the organization and C. S. Comeaux is executive secretary.

FINANCIAL NEWS

United Carbon Company

First Quarter: Net income of $804,068, which is equal to $1.01 a share, and which compares with $813,878, or $1.02 a share, in the corresponding period of 1947. The earned-per-share figure for the 1947 period reflects a 2-for-1 stock split in May, 1947. The consolidated balance sheet as of March 31, 1948, indicated total assets of $28,187,883, current assets of $12,707,218, and current liabilities of $3,575,238.

Lee Rubber & Tire Corp.

Six Months to April 30: Net profit of $923,640, which is equal to $3.64 each on 253,584 shares, against $1,391,636 or $5.76 each on 241,509 shares for the similar period last year. Net sales for the period amounted to $16,665,913, which compares with $19,278,294 in 1947.

Norwalk Tire & Rubber Co.

Six Months to March 31: Net loss, after $18,225 tax carry-back credit, amounted to $29,736 on sales of $3,402,194. This contrasts with a net profit of $186,519, or 92 cents a common share, on sales of $5,622,667, for the similar period last year.

Rome Cable Corporation

Year to March 31: Net profit of $1,152,579, which is equal to $2.83 a share on net sales of $25,202,853, and which compares with a net profit of $1,359,593 or $3.43 a share on sales of $18,436,305 for the previous fiscal year.

Thermoid Rubber Company

First Quarter: Net income of $284,974, which is equal to 35 cents a share and which compares with $261,463 in a comparable period of 1947, for which no share earnings were reported.

Columbian Carbon Co.

First Quarter: Net income of $1,968,644, which is equal to $1.22 a share on sales of $10,599,258, and which compares with $1,622,083, or $1.01 a share on sales of $10,530,681, for the similar period last year.

O'Sullivan Rubber Corp.

For 1947: Net loss of $168,321, which compares with a net income of $251,333 in 1946. Net sales in 1947 amounted to $4,384,940, against $6,204,282 in 1946.

Anaconda Wire & Cable Co.

First Quarter: Net profit of $1,833,469, which is equal to $2.17 a common share, and which compares with $2,483,213, or $2.94 a share last year.

Continental Buys Black Plant

The Continental Carbon Co., New York, N. Y., has purchased a surplus carbon black plant located at Sunray, Texas, from the War Assets Administration for the sum of $1,100,000. The company, wartime operator of the plant, has been operating it under a lease agreement dated December 7, 1944, and has paid the Government accrued rentals amounting to $620,000. The plant employs approximately 50 persons. WAA said that the sale price is 95.6% of the appraised fair value of the facility. Its original cost to the Government was $2,177,741, which included $927,482 for real property and $1,250,259 for equipment. Because of possible changes in supplies of gas necessary to operate carbon black plants of this type, the purchaser was given the right by WAA to relocate the plant within the continental limits of the United States without prior approval by WAA. The sale is subject to an opinion by the Department of Justice that the sale does not violate anti-trust laws.

Monsanto Buys Surplus Plant

The Monsanto Chemical Co. has purchased a surplus synthetic rubber plant from the War Assets Administration for $169,500. The plant, located adjacent to the Monsanto Plastics Division plant at Springfield, Mass., was built by the company for the government during the war, and was originally used for the production of polydichlorostyrene. The plant was then partially reconverted and materials for synthetic rubber were produced for the Office of Rubber Reserve. When this work was completed, Monsanto leased the plant for the manufacture of an oil additive. Company officials stated that the manufacture of oil additives would be continued at the plant. The purchase is contingent on approval by the Department of Justice.

Rayon Plant Starts Operation

Full-scale production operations at the new $26,000,000 American Enko corporation rayon plant at Morristown, Tenn., has begun for the manufacture of rayon yarn for automobile, truck and airplane tires. One of the largest industrial facilities constructed in the United States since the end of the war, the American Enka plant was designed and built by the H. K. Ferguson Co. The new plant will employ more than 1000 persons and will manufacture approximately 20,000,000 pounds of rayon tire yarn annually. Construction at the 20-acre site started about 18 months ago.

Armstrong Cuts Tile Prices

The Armstrong Cork Co., Lancaster, Penna., has reduced its factory prices on rubber tile and Linotile. Reductions on rubber tile range from 3¼ cents to 5¾ cents per square foot for standard colors and from 5½ cents to 8 cents for deluxe colors. The price of Linotile has been reduced 5½ cents per square foot. Price reductions were attributed to operating economies which have been effected.

BLACK PRODUCTION AND SALES HIT NEW HIGHS FOR YEAR 1947

A total of 1,318,965,000 pounds of carbon black were produced in the United States during 1947, which compares with a total of 1,244,421,000 pounds of black produced during 1946, accordilng to the U. S. Bureau of Mines. Of the 1947 total, 653,966,000 pounds were of the channel type and 664,999,000 pounds were of the furnace type. In 1946, 619,109,000 pounds of channel type, and 625,312,000 pounds of furnace type were produced. It was the second consecutive year that the production of furnace black was greater than the production of channel black.

Minor expansion of sales to rubber and ink manufacturers accompanied declines in sales to paint and miscellaneous industries. Of domestic sales 94 per cent went to rubber companies, 3 per cent to ink companies, 1 per cent to paint companies, and 2 per cent was used for miscellaneous purposes. Total sales increased 4 per cent in 1947, compared with an increase of 24 per cent in 1946 over 1945. Total sales of black in 1947 were 1,319,760,000 pounds, of which 319,076,000 pounds were exported. Total sales of black in 1946 were 1,269,740,000 pounds, of which 271,085,000 pounds were exported.

Stocks on hand totaled 75,112,000 pounds on December 31, 1947. Of this total, 8,619,000 was of the channel type of 66,493,000 was of the furnace type. On December 31, 1946, stocks held by producers totaled 76,228,000 pounds, of which 17,006,000 was channel type, and 59,222,000 was furnace type. Stocks of furnace blacks have increased annually since 1943.

Average Yield of Black

The average yield of carbon black per thousand cubic feet of gas used increased from 2.44 pounds in 1946 to 2.51 in 1947, reflecting increased production of furnace blacks which have considerably higher yields than the channel types. The total quantity of natural gas used in 1947 was 484,882,000 cubic feet compared with 478,349,000 cubic feet in 1946. The average value per thousand cubic feet of gas increased from 3.02 cents in 1946 to 3.57 in 1947. Over 31,000,000 gallons of iiquid hydrocarbons were used in 1947 in addition to the gas.

The average value at the plants of both channel and furnace type blacks increased 0.53 cents per pound in 1947 over 4.82 in 1946 to 5.35 cents. Total value of carbon black at plants in 1947 was $70,639,000, which compares with $59,988,000 for 1946.

In all, 63 plants and 21 operators were active in 1947 compared with 60 plants and 22 operators in 1946. One new furnace plant and two new channel plants were operated in Texas. One channel plant in Texas was shut down and one in Kansas that was shut down during 1946 was put in production in 1947.

Louisiana produced 190,252,000 pounds of black in 1947, against 191,857,000 pounds in 1946. The Texas Panhandle district produced 633,250,000 pounds in 1947, against 596,678,000 pounds in 1946. The rest of the state produced 262,523,000 pounds of black in 1947, 234,172,000 pounds in 1946. Totals for Texas were 895,773,000 pounds produced in 1947, against 830,850,000 in 1946. Other states, including California, New Mexico, Kansas and Oklahoma, produced 232,940,000 pounds of carbon black in 1947 as against 221,714,000 pounds in 1946.

"Kube-Kut" Wood Flour

Michael Wood Products, Inc., 625 Midland Ave., Garfield, N. J., is currently offering "Kube-Kut" wood flour for drying, polishing and general finishing of molded rubber, plastics, metal and similar products. The material is made from green maple sawdust at logging operations. It is properly screened (mechanically sifted to insure uniformity in particle size), bark is eliminated, dried in a heated rotary dryer, and then screened again to obviate fine particles. The absence of elongated slivers is said to make the finished wood flour easy to shake free from products treated with it, as in the case of drying and polishing operations. "Kube-Kut" wood flour is available in a variety of meshes to suit individual needs.

Czech Rubber Goods Production

According to the U. S. Department of Commerce, the immediate object of the first half of the Czechoslovak Two-Year Plan was to attain volume in production. The nationalized rubber and leather industries expanded more rapidly than any others. It is reported that the 1947 output of rubber footwear reached 19,272,833 pairs, or 139.7 per cent of the Plan. The industry also produced 2,480,020 bicycle and motorcycle tires in 1947, which compares with 1,109,000 units produced in 1946, and is 112.5 per cent of the amount scheduled. Bus and truck tires produced in 1947 amounted to 512,214 units, 102.1 per cent of the quantity planned. In 1946, 203,350 units were produced.

Pequanoc Elects Officers

At a recent meeting of the Board of Directors of the Pequanoc Rubber Co., Butler, N. J., the following officers were elected: *President,* Thomas N. D. Mace; *Vice-President,* Frederick E. Traflet; *Secretary-Treasurer,* M. T. Gunter; *Assistant Treasurer,* Newton T. Tuthill. Mr. Traflet recently resigned as president of Pequanoc due to ill health.

FIRESTONE TRACK-TYPE LANDING GEAR UNDERGOING EXTENSIVE TESTS

C-82 Fairchild Equipped With Flying Runway

The new Firestone track-type landing gear pictured above, popularly called the "Flying Runway," is receiving serious consideration by the Air Forces as an alternative to construction of costly runways for the nation's new very heavy bombers and transports. The gear now is undergoing successful landing, take-off and taxi tests on this large Fairchild C-82 transport plane. By distributing a plane's weight over a greater runway surface than is possible with tires, the Firestone endless rubber belt type landing gear will enable our largest aircraft to land on present runways at most military airfields. First public demonstration of the "Flying Runway" was made in New York during the May 12-15 convention of an aviation group.

NEW RUBBER GOODS

Playtex Rubber Air-Nurse

The Playtex Air-Nurse, a combination safety chair, bassinette, baby bath, crib and auto seat, etc., has been developed and introduced by the International Latex Corp., Dover, Delaware. The versatile device

performs a number of chores, all designed to relieve the work of watching and caring for baby. For travel purposes, it is equipped with safety anchors on all four corners so that it can be fastened to a chair or seat on plane, bus, train or car. Weighing less than a pound, it is an air-cushioned device. A wide band on its petal-finish, sanforized cotton cover holds the infant securely, allowing complete freedom of motion at the same time. With removal of the cover, the Air-Nurse becomes a sanitary bath. Since it fits into any standard sized carriage, it can also be used as a comfortable, air-cushioned carriage mattress. The playtex Air-Nurse is waterproof and air-tight, and inflates easily and quickly in one minute. When not in use it can be deflated and folded to handbag size. It comes gift-packaged.

"Satusply" Plastic Material

The U. S. Rubber Co. is now producing in quantity a new type of decorative material in which paper or cloth is completely impregnated and surfaced with a polyester thermosetting resin, then processed under heat and tension. Known as Satusply, the material is being produced in 34 different colors and patterns, with gloss or satin finish, and is suitable for both horizontal and vertical surfaces, according to the company. The protective coating formed by the resin makes the non-porous plastic material washable and resistant to stains, alkalies and wear. The material finds application in wall coverings, furniture surfacings, and tops for tables, counters and desks. The company is also producing a special cement, called Satusply-Sement, to bond the material satisfactorily to the base surface.

Rubbermaid Kar-Rugs

Wooster Rubber Co., Wooster, Ohio, has introduced a complete line of Rubbermaid Kar-Rugs, described as the original throw rugs for automobiles. Made of a new rubber compound, the "rugs" are available in five separate colors to match or harmonize the brilliant auto interiors, upholstering and seat covers which feature

today's automobiles. They come in three different sizes, engineered to fit the front and rear of any car. Not only do these Kar-Rugs keep cars looking new, but they are handy for emergency use. For example, they protect clothing when one is kneeling to change tires, and they may be placed under wheels to provide traction in snow or mud.

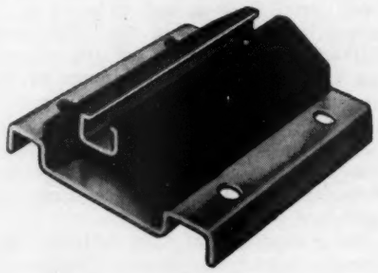
Latest Kaysam Latex Joy Toy

Molded Latex Products, Inc., Paterson, N. J., has introduced a new Kaysam latex Joy Toy molded after Elsie the Cow's new

baby boy, "Beauregard." Made by the patented Kaysam process of pure, soft latex, Beauregard's features are carefully molded and accentuated by harmless colors, the company stated.

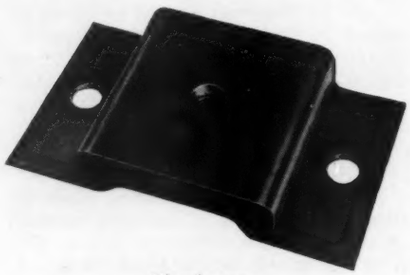
New Lord Rubber Mountings

The Lord Manufacturing Co., Erie, Penna., has developed and introduced two new types of rubber mountings, called "Chan-L-Mount" and "Shockmount", respectively. Chan-L-Mount, described as "packaged vibration control," features easy



Chan-L-Mount

installation, strength and adaptability. It is 1½ inches high and is installed by sliding under the machine to be mounted. A deflection of ¼-inch enables this mounting to isolate frequencies as low as 600 cpm, in addition to all higher frequencies. It is recommended by the company for such installations as pumps, air compressors, motor generators, refrigerators, etc. The Shockmount mounting is designed to control shock, isolate high frequency vibration, and reduce noise transmittance to



Shockmount

the floor. It is a heavy duty mounting, with load capacities up to 7500 pounds per mount. The company claims that this mounting reduces the need for massive foundations to achieve inertia, and permits the placing of heavy machines where it would otherwise be impractical. Shockmount is 1-13/16 inches high and features rugged 3/16-inch steel construction. The top plate contour limits movement and sheds oil and dirt. The fixing element is oil-resistant synthetic rubber.

New Rubber Duck Decoy

The Electric Eye Equipment Co., Danville, Ill., has acquired exclusive rights to manufacture and distribute a new type of rubber duck decoy. The decoy is convex bottomed so that it rides upright in the roughest water. It is self-sealing against stray shot and can be used in rubble as well as water. The decoys, known as the Duraduck, are currently being manufactured for the company, but plans are being formulated for the installation of a rubber plant at Danville in the near future.

Giant Size Whistle Toys

A new line of giant size whistle toys, to retail at 98 cents, was recently introduced by the Eastern Rubber Specialties Co., South Norwalk, Conn. The line includes "Clifton Bear" and "Hortense Cat," both of which are illustrated herewith. The

giant size toys are 8½ inches high, of hollow construction, light in weight with thick walls. They feature harmless painted eyes and decorations and are equipped with large, loud whistles of rustproof aluminum. The toys are washable with soap and cold water and come sanitary packed in cellophane wrappers.

Double Eagle Bicycle Tires

Two new sizes of bicycle tires have recently been added to the Goodyear Tire & Rubber Company's line. The tires are the 20 x 2.125 and 24 x 2.125 Double Eagle, a premium product manufactured by Goodyear. The 20-inch unit is designed primarily for use on front wheels of cycle trucks requiring tires of exceptionally sturdy construction, while the 24-inch tire is said to be particularly suited for special vehicles such as push-carts. The new tires round out Goodyear's Double Eagle line, previously manufactured in the 26-inch size. Both new sizes are available for immediate shipment, company officials stated.

Witco Carbon Black Chart

The Witco Chemical Co., 295 Madison Avenue, New York 17, N. Y., has recently published a new carbon black chart covering competitive grades of the company's rubber blacks and color blacks. Some of the information which the chart offers includes average particle diameter, surface area, crystallite volume, density in water, oil absorption, iodine adsorption, tinting strength and pH. The chart is now available for distribution. Copies may be obtained upon request to the company.

Foam Rubber-Backed Rug

The Bigelow-Sanford Carpet Co., Inc., will introduce a foam rubber-backed carpet as soon as final testing results have been established. Said to be an advance in carpet manufacturing, the rug will be subjected to practical tests this fall before being commercially offered.

Offers New Styrene Copolymer

The Dewey and Almy Chemical Co., Cambridge, Mass., has announced a new high styrene copolymer developed especially for stiffening GR-S sole compounds. It is designed for light color and has a low specific gravity. The resin, Darex Copolymer X43, is said to give excellent abrasion resistance and long flex-life together with low plasticity at processing temperatures which reduces mixing time. It is reported that the material meets all the specifications of a thermoplastic type special purpose rubber resin. The new product follows the price reduction recently announced by the company on its other rubber resin products, Darex Copolymer 3 and X34.

Cork-Neoprene Combinations

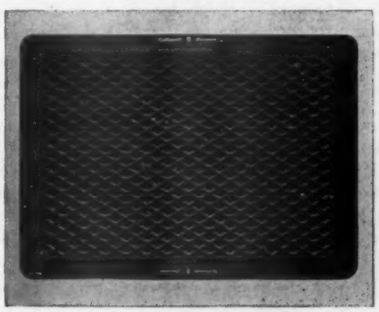
Some of the interesting properties possessed by combinations of cork and neoprene are discussed in the March, 1948, issue of *The Neoprene Notebook*, house organ of the Rubber Chemicals Division, E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware. The effect of compressing gaskets made of a neoprene-cork composition and an all-neoprene composition between two metal flanges is illustrated. The same issue also contains a description of neoprene-jacketed cable.

Rubber Plant for Ceylon?

According to report, both British and American rubber manufacturers are dickering with the Ceylon Government for permission to establish a rubber factory in that country. At present Ceylon boasts only of a handful of small-scale factories, including two retreading plants. In 1947, the country spent some $2,000,000 for importing auto and bicycle tires and quality rubber goods.

"Sav-A-Mat" Car Floor Mat

Stello Products Co., 704 S. Main, Hutchinson, Kan., has announced production of an unusual rubber tread car floor mat. Named "Sav-A-Mat," the floor cov-



ering is made of a specially compounded rubber for long lasting qualities. Construction of the bottom side prevents slipping, and the ribbed design on the top surface catches and holds dirt. The mat can be removed and cleaned at any time.

Ipco Utility Rain Suits

The International Products Co., 2803 N. Fourth St., Philadelphia, Penna., has announced two styles of improved wet-weather garments. Manufactured of a double texture fabric with a sheet of solid

rubber vulcanized in between, the rain suits are patterned in both one piece and two piece styles. The suits are designed for workmen who must work outside regardless of the weather, and are said to be absolutely water and windproof.

Form New Lead Company

Formation of the Associated Lead and Zinc Co., incorporated in the state of Washington, was announced in Cincinnati, Ohio, on May 2, by J. M. Bowlby, president of the Eagle-Picher Sales Co., and Roger H. Cutting, president of the Northwest Lead Co., Seattle, Wash. It was stated that the newly-formed company will be separate and distinct from either of its parent companies and will be principally engaged in the manufacture of lead oxides and allied products.

Giant Vulcanizing Press

A new 4800 ton hydraulic press for vulcanizing large rubber conveyor belts has been completed for delivery to the Manhattan Rubber Division of Raybestos-Manhattan, Inc., Passaic, N. J. The press was engineered and built by the Baldwin Locomotive Works at its Southwark plant in Eddystone, Pa. The machine is approximately 13 feet high, 9 feet wide, and 53 feet long. It is designed for a working pressure of 2,500 pounds per square inch.

"Rugback" Backing Material

The U. S. Rubber Co. has announced the production of "Rugback," a form of white liquid rubber for painting the backs of rugs. The product is said to anchor the loops of hooked rugs, preventing the tufts from pulling out; it helps prevent accidents by de-skidding any type of rug; and it makes rugs lie flat, preventing curling. The liquid backing material dries in an hour to form a tough transparent film whcih remains permanently flexible and lengthens the life of the rug.

CANADIAN NEWS

The $20,000,000 synthetic rubber industry in Sarnia is not afraid of natural rubber competition, officials said recently. It is attracting $37,000,000 worth of new business, with an unprecedented boom to follow.

Although the Crown-owned Polymer plant at Sarnia stands to lose a huge business deal with the United States Government, involving the sale of more than 30,000,000 pounds of rubber a year, officials say they are not worried. The discovery of a new type of synthetic rubber "to beat crude rubber for automobile tires" will skyrocket demands.

The new synthetic rubber, it was learned, is being produced in the United States, and also is being produced in experimental quantities at the Sarnia plant. Commercial production will begin in the fall.

Officials said the plant is continuing a steady production of 100,000,000 pounds of rubber a year, and that the plant is not losing money.

For the last three months the United States Office of Rubber Reserve has been taking the Canadian plant's exportable general rubber surplus, which amounts to about one-third of total production. With expiration of the agreement the U. S. Congress is believed to be studying action to renew the contract.

Canadian consumption of Buna-S, including latices, amounted to 3,320,024 pounds in February. This is short of the 3.5 million pound consumption required to entitle consumers to a rebate on the price of 18.5 cents per pound from Polymer Corp., Ltd.

Effective April 16th, Polymer increased its charges for freight equalization by 10 per cent. This change was found necessary because of the general increase of 21 per cent in freight rates granted to Canadian railways during the month. Polymer's new equalized rates are .55 cents per pound for carload quantities and 1.1 cents per pound for less than carload quantities.

Stocks of natural rubber in Canada at the end of March were higher than a year before, while holdings of synthetic and reclaim rubber were lower, according to the Dominion Bureau of Statistics. Natural rubber stocks were 5,585 tons compared with 4,473 a year ago, synthetic 3,862 against 5,344, and reclaim 2,401 against 2,872.

Domestic consumption of natural rubber in March amounted to 3,882 tons compared with 2,440 a year ago, synthetic 1,797 tons against 2,876, and reclaim 1,359 against 1,570. Domestic production of synthetic was reduced to 3,560 from 4,466 tons a year ago, while reclaim rose from 360 to 427 tons.

W. H. Miner, president of the Miner Rubber Co., Ltd., Granby, Que., has been re-elected president of the Rubber Association of Canada. G. B. Smith, Toronto, continues as manager and secretary.

O. H. Barrett, assistant to the president of Goodyear Tire and Rubber Co. of Canada, Ltd., co-ordinated Toronto activities in connection with World Trade Week, held May 30-June 5th. Trade Week is designed to drive home the importance of the international trade to Canada's economy and the welfare of Canadians as individuals.

Another High Polymer Forum

The High Polymer Forum, which is sponsored by several divisions of the American Chemical Society and which has become a regular feature of the semi-annual meetings of the Society, will be held during the 114th National Meeting, covering the period from August 30 to September 17, 1948. This meeting will be held in three consecutive but widely separated sessions, at Washington, D. C., St. Louis, Mo., and Portland, Ore. The High Polymer Forum, under the sponsorship of the division of Organic Chemistry, will be held during the St. Louis session, September 6 to 10. Cheves Walling, of the General Laboratories, U. S. Rubber Co., Passaic, N. J., will act as chairman of the Forum. Papers intended for presentation at the Forum should be in the hands of Mr. Walling or the secretary of the appropriate division by June 21.

Data on Marvinol Resins

The April, 1948, issue of *The Martin Star*, house organ of the Glenn L. Martin Co., Baltimore, Md., is completely devoted to the line of Marvinol resins recently introduced commercially by the company, particularly Marvinol VR-10. Among the articles in the issue is a description of Marvinol VR-10 by Robert H. Kittner, vice-president of the Martin Chemical Division; a description of the Painesville, Ohio, plant by H. S. Curtis, plant manager; a discussion of the technical activities of the Chemicals Division by C. F. Ruebensaal, technical director, and an outline of the versatility of Marvinol VR-10 by Harold M. Parsekian, director of sales and technical service. Copies of the issue are available from the company on request.

Reduce Darex Copolymer Prices

Dewey and Almy Chemical Co., Cambridge, Mass., has announced a material reduction in the price of its Darex Copolymers (high styrene rubber resins). Effective May 20, prices ranged from 35c to 38c a pound, depending on type and quantity. Prices are f.o.b., Cambridge.

Manufacture of Carbon Black

The manufacture of carbon blacks used in the production of tires and high quality rubber products is described in two reports now on sale by the Office of Technical Services, Department of Commerce. The first report, prepared by British Intelligence Objectives Sub-Committee investigators, is a general survey of carbon black manufacture at six major German firms. It also includes a comprehensive discussion of lamp black manufacture. Mimeographed copies of this report ("Investigation into Manufacture and Use of Carbon Blacks and Lamp Blacks in Germany," PB-46388, 120 pp.) sell for $3.25. The second report, called "Acetylene Carbon Blacks" (PB-80399, 18 pp.), prepared by OTS Investigator Fred S. Thornhill, furnishes details on German manufacture of acetylene black, including the "static" and "continuous" processes. It sells for 50c a copy. Orders for the reports should be addressed to the Office of Technical Services, Department of Commerce, Washington 25, D. C., and should be accompanied by check or money order payable to the Treasurer of the United States.

Peroxide Resistant Rubbers

Formulas for German-developed hydrogen peroxide resistant rubbers used in gaskets and rings where contact with concentrated hydrogen peroxide is involved are described in a report now on sale by the Office of Technical Services, Department of Commerce. The report was prepared by American investigators following the investigation of the preparation, utilization and handling of concentrated hydrogen peroxide. The information in the report was obtained from the German firms Carl Freudenberg at Weinheim, Wetzell Hummiwerke A.G. at Hildescheim, and I. G. Farbenindustrie at Leverkusen. Mimeographed copies of the 6-page report (PB-85151, "Rubber Compositions Resistant to Highly Concentrated Hydrogen Peroxide") sell for 25 cents. Orders should be addressed to the Office of Technical Services, Department of Commerce, Washington, D. C., and should be accompanied by check or money order payable to the Treasurer of the United States.

Geon Water-Borne Plastic

A new water-borne plastic which should prove particularly useful in the decorative coating and film fields has been announced by the B. F. Goodrich Chemical Co., Cleveland, Ohio. This material, called Geon polyblend latex, is a colloidal blend of Geon polyvinyl chloride and Hycar nitrile rubber. It is supplied as a liquid containing 45-50% solids, with a specific gravity of 1.08. The latex is said to dry at room temperature to a tough, water-white film with excellent greaseproofing qualities. The film has a tear resistance of 1000 pounds per inch, a tensile strength of 2000 psi and an elongation of 350%. The material is available at present in sample quantities only, but will be ready for commercial marketing within the next few months.

LOS ANGELES NEWS

The June 1st meeting of the Los Angeles Rubber Group featured the regular meeting of the Technical Group, the usual excellent dinner at the Hotel Mayfair, and an interesting address by Dr. Robert E. Fitch, Dean of the Faculty of Occidental College.

Dr. Fitch discussed "American Morals and American Destiny," and emphasized the point that the present need of the American people is to awaken once more to the reality of the moral law. He pointed out that the affairs of nations, as much as the lives of individuals, are governed by the principles on which they act, and it is possible to work out bases of compromise with nations with whom we have some agreement on fundamentals, even though we disagree on immediate issues. Dr. Fitch's address was well received.

The Technical Meeting, which as usual preceded the regular meeting, featured a panel discussion on the subject, "Compounding of Mechanical Rubber Goods." Numerous questions were submitted in advance to the panel, which consisted of the following: Del Schade (Ohio Rubber), Andy Matelik (Kirkhill Rubber), Fred Woerner (Reeves Rubber), Raymond Stringfield (Fullerton), and Bill Snyder (Vanderbilt).

This technical session was by far the best held in a long time, with over 75 members and guests in attendance. Questions and answers, with resulting discussions, were of such interest that it was difficult for George Miller (Voit Rubber), chairman of the Technical Group, to bring the session to a close.

Copies of all questions submitted to the panel, with their answers, are now being prepared and edited by a special technical staff, and further information with regard to the panel will appear in an early issue.

Charles F. Hosford, Jr., formerly president of the Pennsylvania Coal Products Co., has been named west coast manager for the Chemical Division of Koppers Co., Inc. Mr. Hosford, who joined Koppers early in 1947 after acquisition by the company of Pennsylvania Coal Products, will have headquarters in San Francisco and will be responsible for all west coast activities of the Koppers Chemical Division.

The plant of the Essex Wire Corporation of California at San Diego is expected to get into full production in the near future. Douglas Horsfall, formerly associated with the Canada Wire and Cable Co., is plant manager.

L. C. "Jack" Weimer has returned to the rubber manufacturing business and is now associated with the Huntington Division of the W. J. Voit Rubber Corporation in technical development and control.

Vic Neske, known to many members of the Los Angeles Rubber Group, recently joined the Kirkhill Rubber Co.

Joseph B. Larkin (Patterson-Ballagh) recently announced wedding plans for September. He will be married to Miss Lena Cook.

Lee Wilson, of the Cal Resin Corporation, and formerly associated with the Consolidated Aircraft Corp. in rubber and plastic development, passed away recently.

Don Post Studios, headed by Don Post, creators of the "pull-on" rubber masks, for many years located in the Chicago area, is now located at 321 Jackson Street in Los Angeles. The factory move was made several months ago and the production of masks is now in full swing at the Los Angeles plant.

Phil Drew (Goodyear), chairman of the Los Angeles Rubber Group, was scheduled to speak on the American Chemical Society program over Radio Station KECA on June 12.

New Cabot Offices in Southwest

Southwestern headquarters of the Cabot Carbon Co., manufacturing subsidiary of Godfrey L. Cabot, Inc., Boston, Mass., for the production of carbon black, will be housed under one roof in Pampa, Texas, as soon as construction of a new, six-story office building is completed. The Cabot company has reserved the top two floors in order to assemble in one place the administrative and field offices of the Texas and Oklahoma Panhandle areas. The Cabot company has also taken an auditorium on the roof, which will be used for divisional meetings of the company's production heads. Construction will begin as soon as plans now being drawn are completed.

Seiberling Borrows $2,000,000

The Seiberling Rubber Co., Akron, Ohio, has made arrangements with the Penn Mutual Life Insurance Co. to boost its working capital by $2,000,000 through a loan. At the same time the company announced in a letter to preferred stockholders it is seeking their approval to substitute a long-term obligation for most of the present short-term borrowings. The loan made with Penn carries an interest rate of 3⅞% and matures in ten years. The company has also augmented its cash funds with other short term borrowings from banks totaling $3,000,000.

Named West Coast Manager

Paul R. Oliver

Farrel-Birmingham Co., Inc., Ansonia, Conn., has announced the appointment of Paul R. Oliver as West Coast Manager, with headquarters at the company's office, 2039 Santa Fe Avenue, Los Angeles, Calif. Mr. Oliver has worked as a service engineer for Farrel-Birmingham since 1942. He was employed from 1938 to 1942 by the American Can Co. and the Ankerite Paint Co. in electrical engineering capacities. Prior to this he worked for 22 years for the B. F. Goodrich Co., at the firm's Akron, Ohio, plant and at the Goodrich factory in Los Angeles. He was in charge of electrical work during construction at the Los Angeles plant in 1927 and remained as plant engineer until 1938. Mr. Oliver is a member of the Northern California Rubber Group and the Southern California Electrical Maintenance Engineers Association.

Announce Vacation Periods

Announcements have been received from several companies regarding shut-downs in the next several weeks for purposes of vacations, repairs, inventory, etc. Among these were the following, with the dates indicating the shut-down period:

Aldan Rubber Co., Philadelphia, Penna.—July 2 to 12.

Associated Rubber, Inc., Quakertown, Penna.—June 25 to July 12.

Mansfield Tire & Rubber Co., Mansfield, Ohio—July 16 to August 2.

Joseph Stokes Rubber Co., Welland, Ontario—June 26 to July 12.

Victor Manufacturing & Gasket Co., Chicago, Ill.—July 2 to 19.

Aquablak Colloidal Carbons

Binney & Smith Co., New York, N. Y., has adopted a new trade name, "Aquablak," for its line of colloidal aqueous dispersions of carbon black. The current series of Aquablaks are said to offer greater intrinsic value to the consuming industries and include specialized types for every potential application. Aquablaks being offered by the company have a specific gravity range of 1.19 to 1.45.

NEWS IN BRIEF

A technical service bulletin covering the application of Plasticizer TP-90-B in various polymers has been made available by the Thiokol Corporation. Ask for Technical Service Bulletin No. 104.

Goodrich Chemical has announced the manufacture of beta-alanine, an amino acid used by the pharmaceutical industry. It will be sold as a raw material for the preparation of pantothenic acid, an ingredient used in conjunction with B vitamins.

U. S. Rubber has begun the full-scale production of aluminum bore hole and mine entrance cables which are said to permit a 30 to 50 percent saving in cost and a 50 percent saving in weight over equivalent copper cables.

"Butex in a GR-I Heat Resistant Compound" is the title of the latest technical report issued by the Midwest Rubber Reclaiming Co., East St. Louis, Ill., on recommended applications of Butex, a neutral process butyl inner tube reclaim. Ask for Report No. 10.

R. M. McGuire, vice-president of the Pantasote Co., Passaic, N. J., will shortly move his office to Detroit to handle the company's growing automotive business and to direct sales throughout the middle west.

A reprint of the article "The Manufacture and Properties of Philprene Low-Temperature Rubber," which appeared in the March, 1948, issue of the *India Rubber World*, has been made available by the Rubber Chemicals Division, Phillips Petroleum Co., Bartlesville, Okla. Copies are available on request to the company.

The Eastern Sales Office of the DuPont Pigments Department has been moved from Newark, N. J., to the Empire State Building in New York City. The office continues under the direction of Lloyd E. Kelly.

A technical bulletin on "2-MT Acceleration for Heat-Resisting Rubber Inner Tube Compounds" has been issued by the DuPont Rubber Chemicals Division. Ask for Report No. BL-224.

Vinyl garden hose, produced in two colors, red and green, and attractively packaged, has been added to the conventional hose line featured by Goodyear. The new hose is made in 25 and 50-foot lengths, complete with couplings.

Adolph Gottscho, Inc., New York City, has made available a new 8-page catalog describing and illustrating 18 different marking and code-dating machines. Most of the machines are automatic and are designed to fit into conventional production line operations.

Production figures released by Goodyear disclose a peacetime record established by that company in the manufacture of some 3,500,000 of its new super-cushion passenger car tires in approximately eight months. They were first introduced by the company in August, 1947.

A new hydraulic hose for airplanes which withstands 3,000 pounds working pressure is now being produced by Goodrich. Special steel wire used in construction of the hose has a tensile strength of over 400,000 pounds per square inch.

A four-page reprint covering the chlorination of benzol has been made available by Glyco Products Co., Brooklyn, N. Y. It includes a flow sheet describing the processes for making and purifying mono-, ortho- and paradichlorobenzols and hydrochloric acids.

Electrical wire manufacturers in the United States are now producing wire for homes and commercial buildings at the record rate of 6,000,000,000 feet per year, nearly three times the pre-war rate, according to U. S. Rubber. Most of the wire is made of copper insulated with rubber.

Production of red inner tubes for bicycle tires has been resumed by Goodyear in the 26 x 2.125 size. Rubber compounds contained in the red tube are forced through fine screen to guarantee freedom from impurities that might result in pin holes.

A. G. Spalding & Bros. has moved its New York district office from 19 Beekman St., to 161 Avenue of the Americas, New York City.

Even-Air Corp., 11 West 42nd St., New York City, is manufacturing a tested compound, viscous in nature, called Even-Air, which, when inserted into an inner tube forms a complete film over the inner surface sealing puncture holes immediately.

The Standard Oil Co. of New Jersey has announced that it expended more than $18,000,000 on research during 1947, about 18% more than was spent during 1946.

Midwest Rubber Reclaiming Co. has made available a technical report in which Midco, a whole tire reclaim, and M-461, a peel reclaim, are compared in mechanical goods compounds. Both reclaims are based on blends of natural rubber and GR-S.

A new three-color, thirty-page bulletin on its complete line of Worksaver electric trucks has been issued by the Yale & Towne Manufacturing Co., Philadelphia 24, Penna. Seven different types of trucks are illustrated and described.

Mortimer Snerd Face Mask

The latest mask innovation from the Don Post Studios, formerly located in Chicago and now at 321 Jackson St., Los Angeles, Calif., is the Mortimer Snerd Face Mask. Like other Don Post masks it carefully follows the facial characteristics of the famous Edgar Bergen character and is put on over the head similar to a bathing cap. The mask, which is priced to retail at $2.95, may be washed and powdered when necessary. Other masks featured by the company include beggars, apes, glamour girls, old women, clowns and minstrels.

U. S. Rubber Closes Plant

A temporary manufacturing plant of the U. S. Rubber Co. in Newport, R. I., has been closed. The plant was opened in 1946 when additional workers could not be obtained at the company's main plant in Providence, R. I. Operations performed at the Newport plant included the winding of golf balls and trimming of heels. At the peak of production the total number of persons employed was 90. More recently this number had been reduced to only 19. Machinery is being transferred back to the main plant at Providence where operations are being consolidated.

Sues VRP Rubber Company

A suit charging patent infringement was filed in Federal Court at Cleveland, Ohio, on June 2 by the Nye Rubber Co. against the VRP Rubber Co. Both companies are located in Barberton, Ohio. The Nye company charges infringement on a patent granted the company in March, 1937, on a mold and method of molding invented by Herbert N. Wayne. Nye Rubber is asking a permanent injunction, an accounting of profits and benefits, and damages. VRP officers are also named in the suit.

Publication of a new edition of "Chemicals by Glyco," a 92-page manual listing and describing the many organic chemical compounds manufactured by the company, has been announced by the Glyco Products Co., Inc., 26 Court St., Brooklyn 2, N. Y.

Where PERBUNAN helps 4,800 horses breathe!

THE FLEXIBLE COUPLING shown above is a mighty important item on the 4800 horsepower Pratt & Whitney engines used in the new Convair-Liner commercial transports.

It connects the air duct to the carburetor... carries in the tremendous feed of air needed for proper gasoline mixture. It has to have hot-temperature dependability... high resistance to oil and high octane gasoline... and lend itself to precise fabrication.

PERBUNAN NITRILE RUBBER was selected for this vital coupling after engineers of Consolidated Vultee and the technicians of Los Angeles Standard Rubber, Inc. ran many exhaustive tests and found Perbunan best suited for the job.

For rubber that resists oil, heat, abrasion and water... holds delicate colors... and stays flexible at low temperatures... write our nearest office.

PERBUNAN
REG. U. S. PAT. OFF.

THE RUBBER THAT RESISTS OIL, COLD, HEAT AND TIME

ENJAY COMPANY, INC. 15 West 51st Street, New York 19, N. Y.; First National Tower, 106 South Main Street, Akron 8, Ohio; 221 North La Salle St., Chicago 1, Illinois; 378 Stuart Street, Boston 17, Massachusetts. West Coast Representatives: H. M. Royal Inc., 4814 Loma Vista Avenue, Los Angeles 11, California. Warehouse stocks in Elizabeth, New Jersey; Los Angeles, California; Chicago, Illinois; Akron, Ohio; and Baton Rouge, Louisiana.

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OBITUARIES

William J. Weaver

William J. Weaver, vice-president of the Ansonia Electrical Division of the Noma Electric Corp., Woodbridge, Conn., manufacturers of plastic insulated wire and cable, died at his home in Woodbridge of a heart attack on June 5. He was 61 years old. Born in Portsmouth, R. I., Mr. Weaver was graduated from Brown University. He was sales manager of the Bryant Electric Co. of Bridgeport, Conn., for several years until 1935, when he joined the Whitney-Blake Co., New Haven, Conn., in the same capacity. From 1942 to 1946 he was vice-president and general manager of the Ansonia Electrical Co., and he was elected to the presidency of that organization in the latter year. When the company was merged with the Noma Corp., in March, 1946, Mr. Weaver was appointed to the position he held at the time of his death. His wife, a brother and a sister survive.

Stanley T. Campbell

Stanley T. Campbell, former president of the Aetna Rubber Co., and more recently associated with the Apex Electrical Mfg. Co., died on May 10 in his home at Euclid, Ohio. He was 59 years old. Mr. Campbell, a native of Buffalo, was president of Aetna until 1939, when he retired to join Apex Co. For a time he was head of the Holland Rieger Division of the company in Sandusky, Ohio. He recently came to Cleveland, Ohio, where he was with the sales division of the parent organization. Mr. Campbell was a 32nd degree Mason. Services were held on May 11 at the Bolton Funeral Home, Euclid. Surviving are his wife and two sons.

Harry P. Pearl

Harry Phillips Pearl, president of the Potomac Rubber Co., Inc., Washington, D. C., died of a heart attack at his home in Washington on June 1. He was 70 years old. Prior to founding the company in 1921, Mr. Pearl was assistant purchasing agent of the Pennsylvania Railroad in Philadelphia, Penna. Funeral services were held on June 3, at Gawler's Funeral Home in Washington, with burial in Holy Redeemer Cemetery, Baltimore, Md. His wife, a sister and two brothers survive.

William P. Hardenbergh, Jr.

William P. Hardenbergh, Jr., retired foreign sales manager of the New Jersey Zinc Co., died on June 5, at the age of 58, in the Memorial Hospital in Morristown, N. J., of injuries he suffered on June 2, in an automobile accident. He leaves his wife and two daughters.

Francis D. Gillen

Francis D. "Hap" Gillen, manufacturer's sales manager for the General Tire & Rubber Co., Akron, died in Toledo, Ohio, while on a business trip at the age of 53 years. Mr. Gillen had lived in Akron all of his life, and was graduated from the University of Akron in 1918. He joined General in 1924. A veteran of World War I, Mr. Gillen was a member of the American Legion and the Veterans of Foreign Wars. He also belonged to the University Club and to the Lone Star Fraternity. From 1936 to 1939 he was a member of the alumni board of trustees of Akron University. Mr. Gillen was active in Boy Scout work and was vice-chairman of the Akron western district. Services were held on May 13 at St. Sebastian's Church in Akron, with interment in Holy Cross Cemetery. He leaves his wife, two sons and two daughters.

Henry Faurot

Henry Faurot, president of Western Felt Works, Chicago, Ill., died at the age of 83 in the Berwyn, Ill., hospital on June 1. Mr. Faurot was born in Albany, N. Y., attended Friend's Seminary in New York, and came to Chicago as a young man. He founded the company which he headed in 1899. He was a member of the Chicago Athletic Club and the Chicago Golf Club. His wife, three sons and two daughters survive.

Joseph Van Bemmel

Joseph Van Bemmel, official in the crude rubber import department of Farr & Co., 120 Wall St., New York, N. Y., died at his home in Teaneck, N. J., on June 4, at the age of 54 years. Mr. Van Bemmel was associated with the import of crude rubber during all of his business life. During World War II he served with the Rubber Reserve Corporation, and in 1946 was Special Representative of the Reconstruction Finance Corporation in New York.

Richard Baybutt

Richard Baybutt, since 1928 head of the Ernest Jacoby Co., Boston, Mass., died on May 22 at his home in Milton, Mass. He was 54 years old. Born in England, Mr. Baybutt was brought ot this country as a boy and attended Cushing Academy. During the recent war he worked for the Federal Government, resigning in 1947 as president of the Rubber Development Organization.

An attractive new folder which describes in detail the complete line of bicycle tires and tubes manufactured by the company has been made available by Goodyear. The folder illustrates the company's bicycle tires, tubes, and semi-pneumatic toy tires.

Mellon Issues Progress Report

According to the latest report covering activities of Mellon Institute (1947-48), the multiple fellowship of the Office of Rubber Reserve has been progressing in a program of development of instruments for the control of the commercial production of synthetic rubber. Of most import to the entire chemical industry are the refractometer and the double-beam infrared and ultraviolet analyzers. The need for a continuous recording refractometer has long been felt in chemical technology. The best design to meet this want operates satisfactorily under pressure, with clear or opaque materials, with pure liquids, emulsions, suspensions, or solutions. The double-beam analyzers are quite important in that purities of materials can be continuously recorded on a plant stream without the usual multicomponent analysis. The many instruments studied for the various types of measurements, according to the report, will afford plant operators opportunities for selection to suit their requirements.

Carbon Black in England

The manufacture of carbon black for the rubber industry in England has been under development by the Severn Valley and Gas Consolidation Group of companies for the past five years. These companies use pitch, tar and oil as base materials. Several years ago the Jones Gas Process Co. Ltd., one of the affiliated concerns, made and sold dry carbon powder from soft pitch at its Gloucester gas works. This company is now making and selling Seval Carbon Black made from fuel oil at its Cheltenham plant. The various plants of the Jones concern are reported to have a combined capacity of 12,000 tons of oil to produce 4,000 tons of carbon black a year.

To Close German Rubber Plants

The United States and British Military Governments have ordered a complete cessation of the production of synthetic rubber in the bizonal area after June 30. The reasons for closing down the industry, which was defined in the Potsdam Agreement as one of those to be prohibited in Germany, were the uneconomical expenditure of coal in production, coupled with the availability of natural rubber. The order will affect two plants in the British zone, which have been producing 500 to 600 tons a month.

Embossed Velon Film Introduced

The Firestone Plastics Co., Akron, Ohio, has announced that Velon film is now being made available to converters in decorator-designed, richly textured yard goods with a three-dimensional effect, for draperies and furniture covers. Company officials stated that the development of new embossing techniques and color printing methods has made this innovation possible, said to be the first of its kind in the vinyl plastics field. The new film will be offered in three textures, making it adaptable to a wide range of applications.

TALES WORTH RETELLING

(No. 5 of a series)

THE DOVE AND THE ANT

AN ANT going to a river to drink one day, fell in, and was swept along by the current. A Dove pitied her condition and threw into the river a small twig, by means of which the Ant gained the shore.

The Ant afterwards, seeing a hunter with a bow aiming at the Dove, stung him sharply on the foot, and made him miss his aim. And so the Dove's life was saved.

★ ★ ★

In business cooperation with others is insurance for success.

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Weathering qualities of
RUBBER PRODUCTS
determined with reliable
accuracy in the

ATLAS *twin arc*
WEATHER-OMETER

Any selected cycle of exposure to sunlight and wetting can be set for automatic continuous testing in the Weather-Ometer. Exact tests can be duplicated at any time by settings on the control panel which contains temperature regulator—time meter—light and water cycle switch — automatic cut-off switch — voltage adjusting switch — direct reading thermal regulator — reactance coil (for economical current consumption). The Weather-Ometer is fully automatic in operation; can be left unattended over night; only necessary to renew carbons once in 24 hours. Years of exposure to any conditions of weathering reduced to a few days testing in the laboratory with the Weather-Ometer.

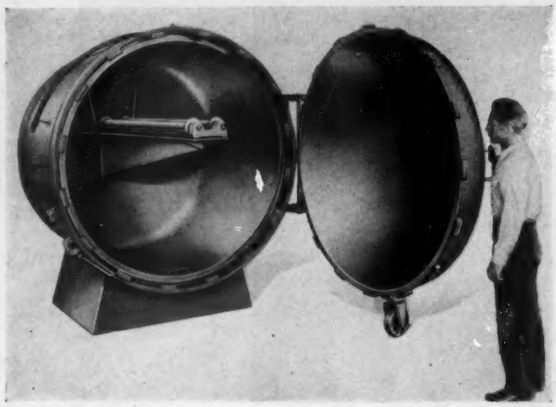
Originators and sole manufacturers of accelerated testing machines for over a quarter of a century. Fade-Ometer, Weather-Ometer, Launder-Ometer — the accepted standard testing machines used all over the world.

ATLAS ELECTRIC DEVICES CO.
361 West Superior Street, Chicago 10, Illinois

NEW EQUIPMENT

Harris Quick-Opening Safety Door

The Harris Quick-Opening Safety Door, built by the United Welding & Manufacturing Co., 8705 Crocker St., Los Angeles 3, Calif., is applicable for use wherever there is need for a quick-opening door on a pressure or vacuum vessel, vertical or horizontal. The Harris door differs from conventional pressure vessel doors in that the sealing mechanism is a free-moving, rotating, indexing ring mounted on bearings. It requires no special tools, gears or hand wrenches and has no threaded parts.



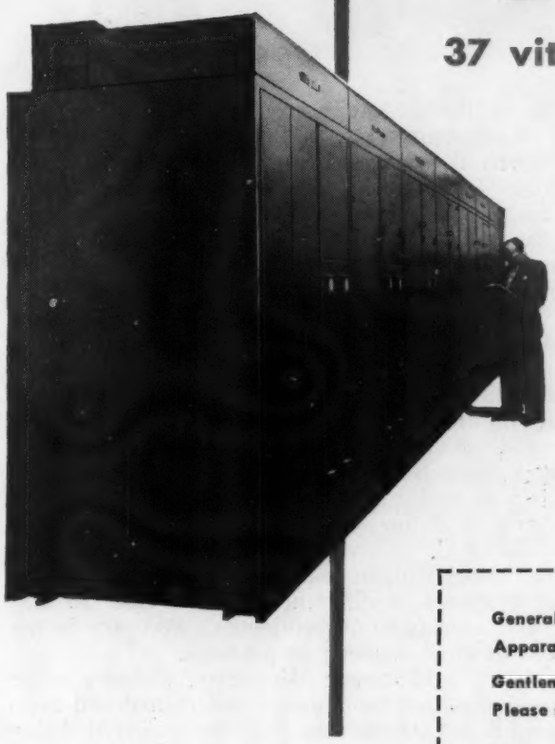
A simple two-step operation is all that is required to open the door. A breaker bar inserted in a leverage slot on the indexing ring turns the indexing ring enough to crack the door and dissipate any remaining pressure or water. In this position the door is still engaged. One further movement of the indexing ring permits the door to swing free. The entire operation takes approximately four seconds. Closing takes only two seconds, the indexing ring being turned to a locked position in one movement. At no time during opening or closing is the operator in front of the door, a safety factor in addition to that afforded during the initial cracking of the door.

The door is available with a short section of shell ready to attach to existing vessels, or as part of a complete vessel. Of all-welded steel construction the Harris Quick-Opening Safety Door is built to code specifications and is available in round or rectangular models. The accompanying illustration shows one of the doors on a specially-built rubber-tired curing chamber.

New Pressur-Tel Valve Cap

As an aid to the extra low pressure tire program, and to help promote correct inflation for all tires, a new Pressur-tel Valve Cap has been announced by A. Schrader's Son, Division of Scovill Manufacturing Co., Inc., Brooklyn 17, N. Y. The correct pressure for the tire is stamped right on top of the new cap in numbers almost ¼-inch high. All the service attendant or motorist has to do is glance at the number on the Pressur-tel Cap and inflate the tire accordingly.

protected...
BY GE LIMITAMP



37 vital operations in this rubber plant

Protection of this plasticator is just one of the vital jobs done by Limitamp starters at the Fisk Tire Plant of the U.S. Rubber Company at Chicopee Falls, Massachusetts. Over a period of four years, more than thirty-seven of these units have been installed in the Fisk Plant to operate generators, mills, Banburys, plasticators—and Fisk plans to add more.

"From a maintenance point of view, I wish we had Limitamp control on all our high-voltage motors." That's what P. L. Butterfield, Chief Electrician at the Fisk Plant says about these controllers.

Decreased maintenance costs are always an important consideration. Users of this equipment have found other advantages: high-interrupting capacity, increased safety, extra-long life, complete motor protection.

You'll need more information about these starters. Fill in the coupon and mail it to us. *Apparatus Department, General Electric Company, Schenectady, N. Y.*

General Electric Company, Sect. B676-259
Apparatus Department, Schenectady 5, N. Y.

Gentlemen:
Please send me your publication GEA-4247 on the G-E Limitamp controller.

Name_____

Address_____

GENERAL GE ELECTRIC

DC MOLD RELEASE EMULSION NO. 35

pays another dividend!

You who have been using our DC Mold Release Emulsion No. 35 know the large dividends it pays in mold maintenance, reduced scrap and improved appearance. Now a new dividend in the form of a 5% price reduction has been declared by Dow Corning. Increasing demand for our Silicone Release Agent has enabled us to produce larger quantities at a lower cost. Our savings are passed on to you. During the past two years while other material costs have gone up, the price of DC Mold Release Emulsion has been reduced by a total of 18%.

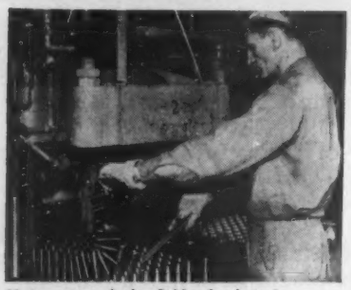
Typical of the many profitable applications found for DC Mold Release Emulsion No. 35 are·

Photo courtesy B. F. Goodrich Company

In molding tires—B. F. Goodrich and other leading tire manufacturers use DC Mold Release Emulsion No. 35 as a mold and curing bag lubricant.

In molding mechanical rubber goods—Emulsion No. 35, applied to press plates gives clean, easy release and freedom from surface defects in the rubber sole stock molded by Baldwin Rubber Co. of Pontiac, Michigan.

Photo courtesy Baldwin Rubber Co.



DC Mold Release Emulsion No. 35 keeps this 81 cavity precision pin mold clean 16 times as long, therefore reducing mold maintenance at Anchor Rubber Products, Inc., of Cleveland, Ohio.

Photo courtesy Anchor Rubber Products, Inc.

DC Mold Release Emulsion gives clean and easy release of rubber goods from even the most complicated molds. Semi-inorganic in nature, it neither carbonizes nor forms a build-up on the mold. It, therefore, reduces mold maintenance to a minimum. Surface blemishes, non-knits, and fold-overs are virtually eliminated, helping to reduce substantially the cost of scrap.

DOW CORNING CORPORATION, MIDLAND, MICHIGAN

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Canada: Fiberglas Canada, Ltd., Toronto
England: Albright and Wilson, Ltd., London

FOR MORE INFORMATION ABOUT DC MOLD RELEASE EMULSION NO. 35, PHONE OUR NEAREST BRANCH OFFICE OR WRITE FOR LEAFLET NO. V 5-7.

Dow Corning
FIRST IN SILICONES

Carson Model K Electronic Micrometer

To fill the need for a lower-cost working standard measuring instrument, the Carson Micrometer Corp., Little Falls, N. J., has announced the new Model K Electronic Micrometer for measuring fine wire, paper thickness, rubber sheet, paint films and other thin materials—hard or soft, conducting or non-conducting. This new instrument measures materials as thing as .0001 in., with an accuracy of 20 millionths of an inch, under anvil pressures as light as ¼ oz. Operation of the instrument is independent of operator skill or sense of touch.

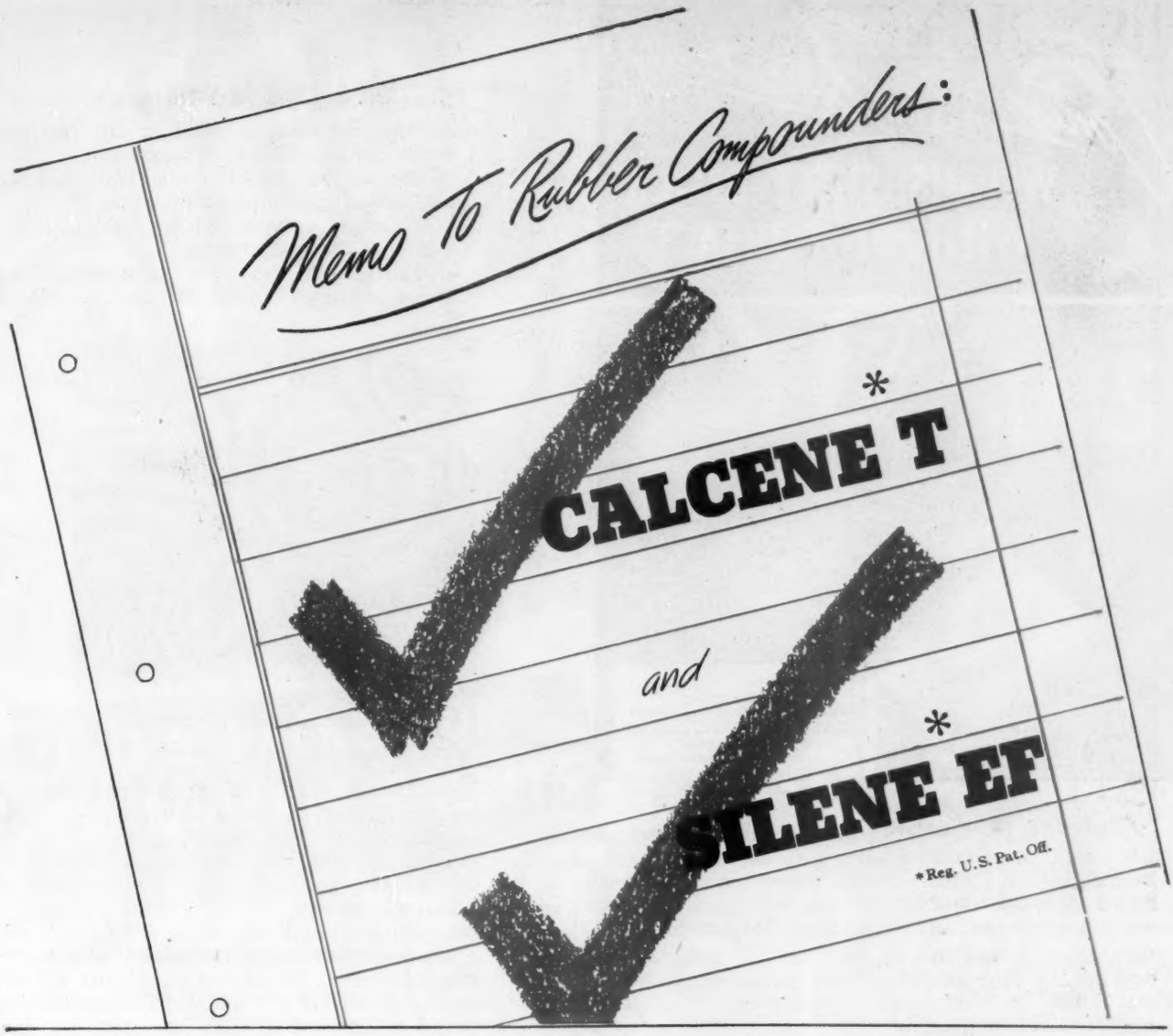
Measuring range of the Model K is ⅛ in., but the micrometer head may be raised to accommodate work

up to ⅜ in. thick. Anvils are of hardened steel and may be of any diameter from 1/64 in. to 5/16 in., with flat or spherical surfaces. Anvil pressure may be any value from ¼ oz. to 1 lb. The standard combination is ⅛ in. flat anvils and 2 oz. anvil pressure, with anvils lapped flat and parallel to 10 millionths.

To operate the instrument, the lower anvil is retracted by a lever at the side of the instrument to insert work. When the lower anvil is released, the upper anvil is lifted by the thickness of work between anvils. The distance the upper anvil is lifted is measured by micrometer dial, with the exact setting indicated by a light on the panel of the electronic unit.

Micrometer dial is 3 in. diameter with white graduations on a black background. Each revolution of the dial is .025 in. as for a hand micrometer. Each .001 in. is numbered, and fine divisions on the dial are .0001 in. The index is readily adjusted to exact zero position at all times without use of special tools. The instrument responds to differences of less than 10 millionths, and repeats to 10 millionths. Accuracy is not influenced by anvil diameter or pressure.

The Model K Electronic Micrometer makes possible precision thickness measurements under anvil and pressure conditions selected to suit the material being measured. Accuracy, sensitivity and repeatability are completely independent of the operator. The instrument is portable, is unaffected by vibration or temperature changes, and requires no leveling. No special skill or training is needed to read dimensions accurately to 20 millionths of an inch on fine wire, capacitor paper, rubber sheet, plastic films, metal strip and foil, etc.



Investigate the possibilities of these two Columbia Pigments

Calcene* T—A specially prepared, coated, precipitated calcium-carbonate of fine particle size—confers high tensile strength, resistance to tear and abrasion, low modulus, smooth, fast extrusion and good general processing properties to natural and synthetic rubber stocks. A pigment of wide utility solving many compounding problems.

Silene* EF—The nearest approach to "a white carbon black." A white, very finely divided, precipitated, hydrated calcium silicate—confers high modulus, hardness, tear resistance, and good tensile strength up to high loadings. Its use is rapidly expanding for many light and dark synthetic and natural rubber products.

Write today for complete data and free working samples.

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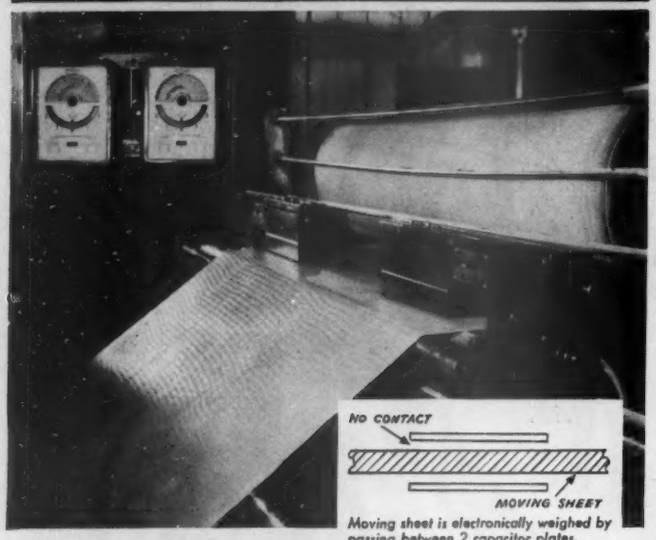
PAINT • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY

Continuously! Electronically!

WEIGHS SHEET STOCK WITHOUT CONTACT



Moving sheet is electronically weighed by passing between 2 capacitor plates.

This Unique System automatically and continuously weighs calendered sheeted material in process . . . indicates instantly any variation in weight of material passing through measuring heads . . . and records weight in ounces per square yard or other suitable units.

By taking advantage of electronic principles, the Verigraph head measures without contacting material. Errors due to speed, surface irregularities and penetration of contacting-type measuring elements are eliminated.

This Foxboro Verigraph Recording System is being used on rubber and plastic sheeting by such leading companies as Goodrich, Goodyear, Firestone, General, and Dow Chemicals. It reduces rejects, improves uniformity, and can save tons of material annually. Write for descriptive Bulletin No. 234. **The Foxboro Company, 256 Neponset Avenue, Foxboro, Mass., U. S. A.**

An exclusive Foxboro development, the Verigraph Weight Recorder applies the speed and sensitivity of electronics to weight recording. Simple to install and operate. Used by leading companies on critical calendering since 1926!

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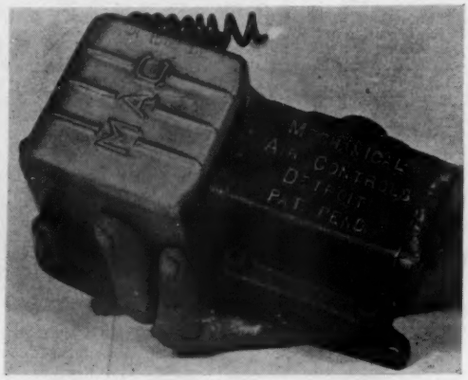
RECORDING
CONTROLLING
INDICATING
INSTRUMENTS

Mac Solenoid Air Valve

A radically improved 4-way solenoid air valve for the control of double acting cylinders is announced by Mechanical Air Controls, Inc., 3049 E. Grand Blvd., Detroit 2, Michigan. The design incorporates the ease of operation of the balanced type valve and the "seal with air pressure" feature of the poppet type.

Simple in construction, the valve's one moving or wearing part consists of two small "O" rings assembled



Four-way solenoid air valve.

on an alloy piston. These "O" rings give positive seals in conjunction with hard chrome seats which are integral with the bronze body. The need of gland packing is entirely eliminated. With long life assured, replacement of the one wearing part is quickly accomplished by removing four cap screws.

Although very small and compact, a full ⅜-inch orifice along with straight-through flow minimizes pressure drop through the valve. Restriction of exhaust will not affect valve operation. Direct solenoid control utilizing only 2.4 amps at 220 volts assures immediate and fast operation for any air application. Available at present in the ⅜-inch size of any voltage or cycle requirements, larger sizes will soon be ready for the market.

WHAT DO BUMPS MEAN TO PHILBLACK O?

FOR FURTHER DETAILS, SEE AD ON PAGE 278

NOW a Champion Clay INNOVATION!!

IT'S PACKED ON EXPENDABLE PALLETS

1. **Cuts Unloading Costs and Time . . .**
2. **Simplifies Subsequent Handling . . .**
3. **Minimizes Bag Breakage . . .**
4. **Reduces Inventory Counts . . .**
5. **Enables Use of Standard Fork Truck Equipment . . .**

CHAMPION—that extra fine, hard, rubber-compounding clay can now be shipped on EXPENDABLE PALLETS for speeding up handling and preventing bag breakage . . . Truly an innovation in clay packing, CHAMPION is first to bring the benefits of this development to you with fine, uniform light-colored clays that are mined and processed with extra care by the National Kaolin Products Company, at Aiken, South Carolina.

Write for full data

HARWICK STANDARD CHEMICAL CO.

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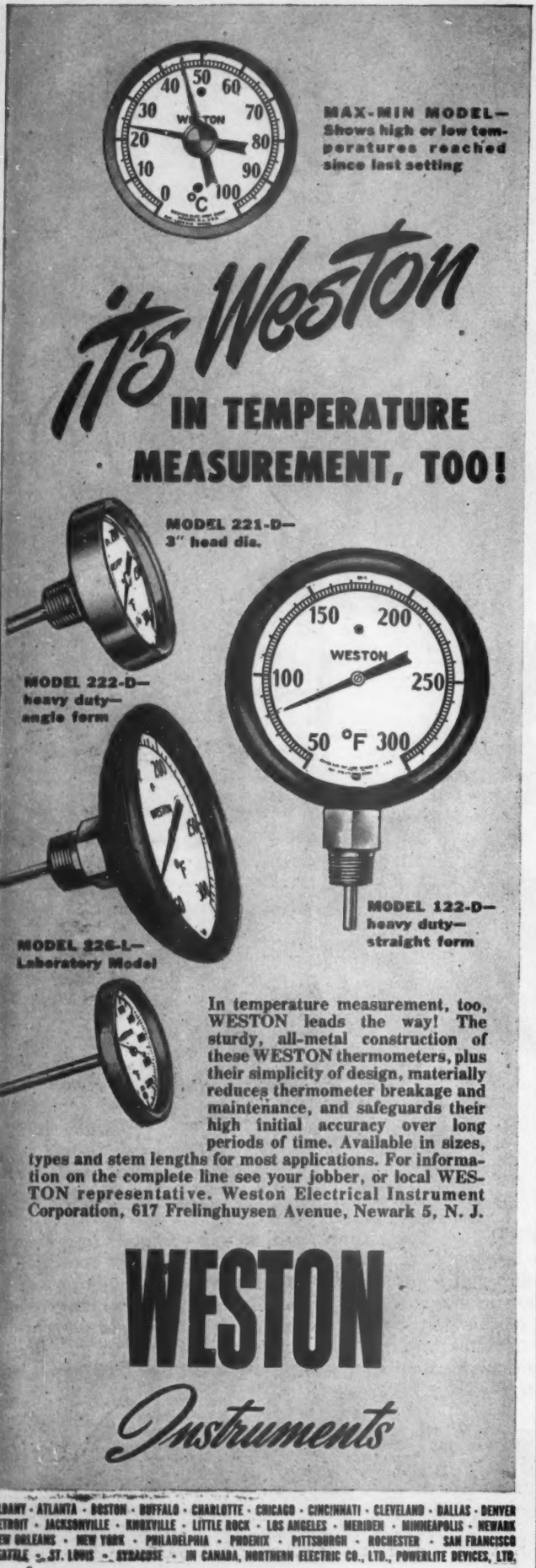
MAX-MIN MODEL—
Shows high or low temperatures reached since last setting
it's Weston
IN TEMPERATURE
MEASUREMENT, TOO!
MODEL 221-D—
3" head dia.
MODEL 222-D—
heavy duty—
angle form
MODEL 122-D—
heavy duty—
straight form
MODEL 226-L—
Laboratory Model
In temperature measurement, too, WESTON leads the way! The sturdy, all-metal construction of these WESTON thermometers, plus their simplicity of design, materially reduces thermometer breakage and maintenance, and safeguards their high initial accuracy over long periods of time. Available in sizes, types and stem lengths for most applications. For information on the complete line see your jobber, or local WESTON representative. Weston Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, N. J.
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SEATTLE · ST. LOUIS · SYRACUSE · IN CANADA, NORTHERN ELECTRIC CO., LTD., POWERLITE DEVICES, LTD.

Goodyear Film Measuring Gauge

A radioactive isotope, byproduct of the atomic energy plants, is the heart of a new gauge for measuring sheets of Pliofilm and other thin films which has been developed by the Goodyear Tire & Rubber Co. The new gauge, developed by Dr. W. E. Morris, utilizes Carbon 14. It makes possible the gauging of a sheet of Pliofilm

or other film continuously as it comes from the rolls, without any mechanical contact with the film being required.

The film passes through a slot in the gauge. Below this slot there is a small bit of Carbon 14. Above the slot there is an ionization chamber in which is produced a minute electrical current by the rays from Carbon 14. This current is amplified by sub-miniature vacuum tubes to the point where it is sufficiently large to operate an ordinary electric meter which will then indicate the strength of the rays. Further amplification could be used to actually control the film gauge by regulation of the speed of the production machinery.

Carbon 14 is one of the weakest of the radioactive isotopes. For all ordinary purposes, its radiations can be regarded as harmless and it does not require the careful shielding that other isotopes require. Many of the isotopes are fully as dangerous as radium. Carbon 14 gives off only a weak stream of beta rays. These are electrons like the electrons released by the filament of an ordinary radio vacuum tube. The number of electrons getting through the sheet of film depend upon its thickness. Consequently the meter can be graduated to read directly in thickness of film.

According to Dr. Morris, the new gauge will read with an accuracy to a hundred-thousandth of an inch although in time it is expected to attain an accuracy of a millionth of an inch. Furthermore, the gauge possesses the virtue of being relatively inexpensive and can be constructed at a cost of a few hundred dollars only.

A self-contained **pressure reducing valve,** designed to receive a varying or high pressure and to deliver a constant reduced pressure under varying loads, has been developed by the Mueller Steam Specialty Co., Inc., Long Island City 1, N. Y. Features include an internal woven Monel wire screen, stainless steel valve spring, a throttling plug type disc, and a large diaphragm loaded with a long flexible spring permitting sensitive operation.

Porcelain Glove Forms

—for dipped rubber gloves, including linemen's or electricians' gloves and surgeons' gloves. Some are made from our own stock molds and others from customers' molds.

Write today for our new catalog covering rubber glove and other forms for dipped rubber goods. Prompt attention given to requests for quotations based on your specifications or stock items.

The Colonial Insulator Company

936 Grant St.
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Chicago Office:
2753 W. North St.

Accelerator 2-MT

by

DU PONT

Has many advantages in rubber stocks

- ★ Resists heat and aging.
- ★ Little tendency to revert during long cures.
- ★ Resists flex cracking.
- ★ Retains tensile strength and tear resistance at elevated temperatures.
- ★ Low heat build-up.

DU PONT RUBBER CHEMICALS

E. I. DU PONT DE NEMOURS & CO. (INC.)
WILMINGTON 98, DELAWARE
BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

DUPONT

Rubber-wise men Specify the BLACK ROCK 4 KBW HYDRAULIC RUBBER BALE CUTTER

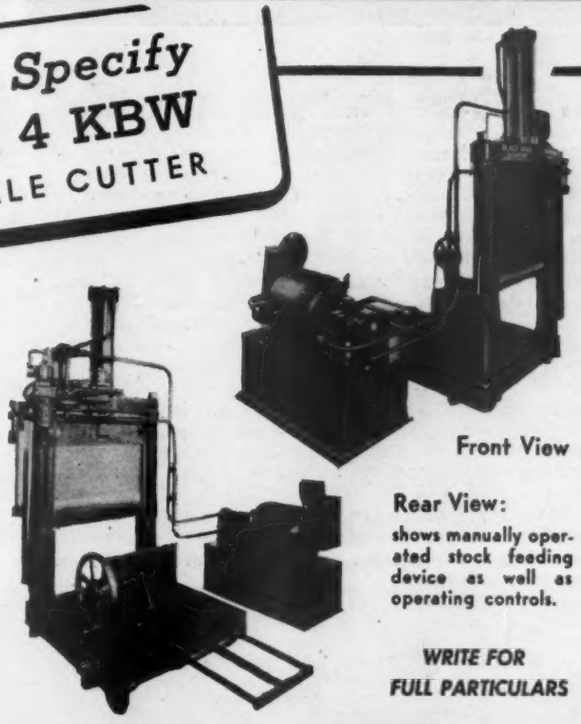
CHECK THESE ADVANTAGES:

- Safety Feature: Knife Can Be Stopped and Reversed At Any Point in Its Cycle
- Cuts Various Shaped Bales of Smoked Sheets, Crepes, Balatas, Paras, etc.
- Opening Under Knife Is 30" Wide by 20" high*
- No Water or Other Cutting Lubricant Necessary

Special Feed and Take-Off Conveyors, Mechanical or Hydraulic, Can Be Supplied in Place of Manually Operated Feed Device Shown.

Rigid Construction — Trouble Free Operation

Our Engineering and Shop Facilities Are Available for Consultation and Development Service



Front View

Rear View:
shows manually operated stock feeding device as well as operating controls.

WRITE FOR FULL PARTICULARS

*4 KBWX has opening of 45" wide by 36" high

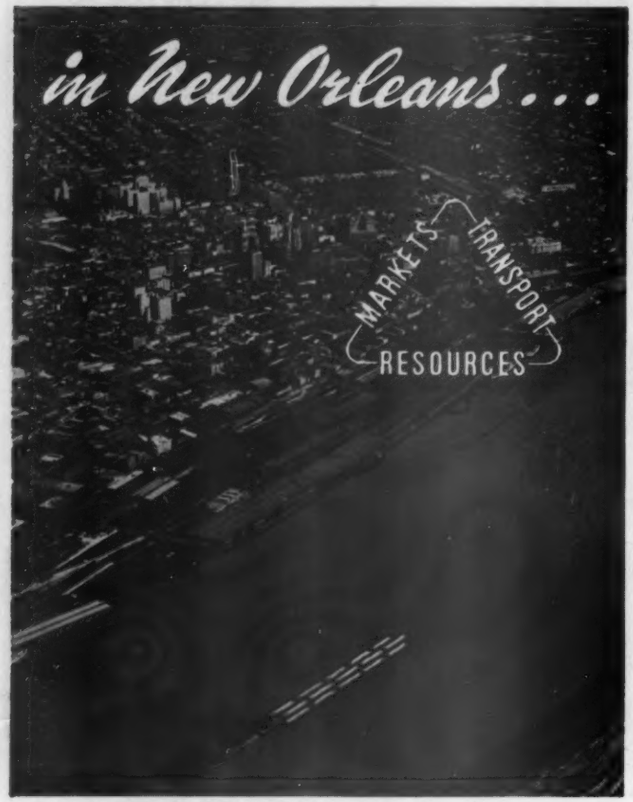
FINE BR TOOLS

BLACK ROCK MFG. CO.

179 Osborne Street — Bridgeport 5, Conn.

Pacific Rep. Lombard Smith, Los Angeles, Cal.
N. Y. Office, 261 Broadway

3 UNUSUAL ADVANTAGES



For Rubber Products Industries

RESOURCES and raw materials for the manufacture of of rubber products are plentiful in New Orleans—cotton, sulphur, carbon black, synthetics etc. are all produced in this area; an unlimited, uninterrupted supply of the ideal fuel, natural gas, is always available; the Port of New Orleans is the natural gateway for rubber imports.

MARKETS are closer, larger and better at New Orleans. Your rubber products plant here would serve 30,000,000 people in the 10-state Southern Market of which New Orleans is the largest city. The vast Mid-continent area and all Latin America can be easily covered at new low transportation costs.

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REVIEWS

BOOKS

Rubber to Metal Bonding. By S. Buchan. Published by Crosby Lockwood & Son, Ltd., 39 Thurloe St., London, S. W. 7, England. 5½ x 8½ in. 240 pp. 21s (approximately $5.00).

Although references to methods of bonding rubber to metal are readily found in the technical literature, and a section on the subject is included in the excellent book on "Rubber in Engineering" issued by the British Ministry of Supply as part of the British Service Investigations, this is the first time that a separate and comprehensive book has been devoted to the subject. Because of the continued growing importance of rubber-to-metal bonding for industrial purposes, a book of this kind needed writing, and the author has done an excellent job.

The book has 18 chapters, in addition to an extensive bibliography and a cross-referenced subject index. The chapters are as follows: (1) Introduction; (2) Plating Plant; (3) Cleaning Solutions; (4) Brass-Plating Solutions; (5) Methods of Analyses; (6) Electroplating; (7) Natural Rubber Compounding; (8) Synthetic Rubber Compounding; (9) Process Control; (10) Processing; (11) Modern Molding; (12) Physical Examination of Brass Deposits; (13) Mechanism of the Rubber to Brass Bond; (14) Properties of the Rubber to Brass Bond; (15) Bonding Cements; (16) Bonding Vulcanized Rubber; (17) Nature of the Non-Brass Bond; (18) The Importance of Design.

Despite the technical advances in bonding which have been achieved in recent years, the author freely admits that much work remains to be done. For example, as he points out in his preface, the goal of a "guaranteed" bond has not been reached; a non-destructive means of examining and testing individual units has to be found; correlation between laboratory test results and service life is lacking; technical data that can be used and understood by the engineer is scanty and, unfortunately, too often inaccurate.

Special emphasis is given to the process which utilizes brass plating as a bonding agent. The author defends this emphasis from the standpoint that it is still the method which appears to be the most reliable and consistent and moreover is generally regarded as the standard against which newer processes are measured and judged. The brass plating bond has few inherent faults, and the main objections raised against its use are that from a technical angle it has not been fully understood and control of the process by the rubber manufacturer has not been entirely satisfactory. A thorough reading of this book will serve to correct the latter factor.

•

Fatty Acids and Their Derivatives. By A. W. Ralston. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 5⅝ x 8⅝ in. 986 pp. $10.00.

This comprehensive work furnishes data on identification, preparation and use of fatty acids and fatty acid derivatives which contain six or more carbon atoms. The term "derivatives" is employed in its broader sense and includes those compounds which can be obtained by employing the fatty acids as the starting material. The subject matter is divided into two sections, the first embracing a description of the fatty acids, their occurrence in nature, their synthesis, and their physical properties, while the second is concerned with the synthesis, properties and uses of the numerous fatty acid derivitives. Dr. Ralston, the author, is assistant director of research of Armour & Co., and a recognized authority on the fatty acid derivatives.

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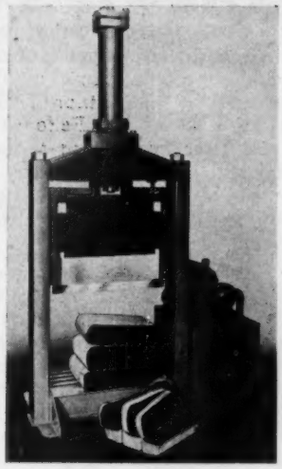

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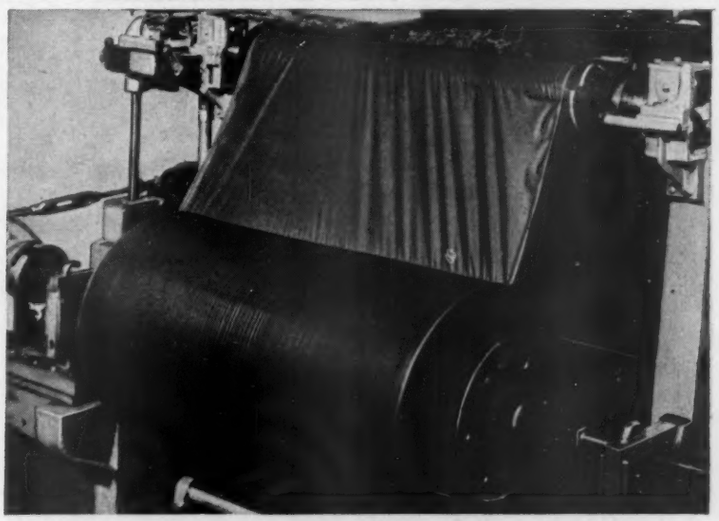

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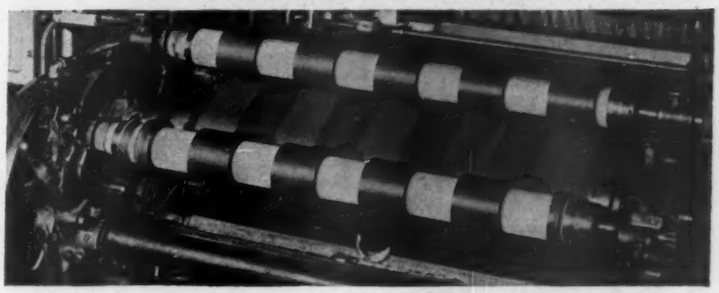

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The Rubber Industry: A Study in Competition and Monopoly. By P. T. Bauer. Published by the Harvard University Press, Cambridge, Mass. 6 x 9 in. 404 pp. $7.50.

Here is an authoritative study of the structure, the techniques, the economics, the history, and the prospects of the rubber industry from 1929 to the present. Most of the research for this study was pursued by the author during his tenure in 1943-45 of the Leon Research Fellowship of the University of London and later brought up-to-date towards the end of 1946 following an extensive tour of the rubber-producing districts of Malaya. On the latter tour, Mr. Bauer prepared an extensive report on the Malayan rubber situation for the British Colonial Office.

The book includes a detailed discussion and a critical evaluation of the International Rubber Regulation Agreement in effect before World War II, valuable data on the monopolistic practices which eventuated in the critical wartime rubber shortage, a review of the rise of synthetic rubber and the principal aspects of future competition between the natural and synthetic products, and a study of the present position and future prospects of the industry as a whole. It is, in brief, a case study in competition and monopoly.

There are 20 chapters in all, divided into six parts, as follows: (1) The Industry to 1933; (2) Establishment of International Regulation; (3) Rubber Regulation in Peace and War; (4) Labor and Technique; (5) The Threat to the Monopoly of Natural Rubber; (6) The Present Position and Prospects of the Industry. In addition, there are several appendices and statistical appendices covering a variety of data.

This book will not be particularly relished by some of the natural rubber producing interests, since it deals in hard facts and argues for lower-priced natural rubber. It does not diminish the importance of synthetic rubber and predicts that the advent of such rubber, combined with the lavish governmental and private expenditure on research into its production and processing, will force the plantation industry, whether competitive or controlled, to greatly increase its expenditure on organized research.

According to Mr. Bauer, the probable answer to synthetic rubber competition "lies in rubber at the lowest possible price, which means smallholders' rubber together with the output of the more efficient estates, supplemented by a reliable supply of latex and possibly by some modified or special rubbers."

•

Standards on Rubber Products: 1948. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Penna. 6 x 9 in. 580 pp. $4.00.

Through the work of its Committee D-11 on Rubber and Rubber-Like Materials the American Society for Testing Materials has issued numerous widely used specifications and tests for materials and products in this field. The latest compilation of standards issued in the Spring of 1948 covers all of this material issued by the Society.

There are two processibility tests—with the parallel plate plastometer and the shearing disk viscometer. Four of the standards involve chemical tests of vulcanized rubber and a large section (115 pages) covers physical tests such as impact resistance, sample preparation, tension testing adhesion, abrasion resistance, hardness, compression fatigue, ply separation, etc. There are numerous aging and weathering tests and several low temperature tests.

Specific products covered by one or more specifications and methods of test include automotive and aeronautical rubber; rubber hose and belting; rubber gloves; matting; tape; and rubber coated fabrics. Also covered are insulated wire and cable; hard rubber and cellular rubber; rubber cements and latices; packing materials; non-rigid plastics; electrical tests, and nomenclature and definitions.

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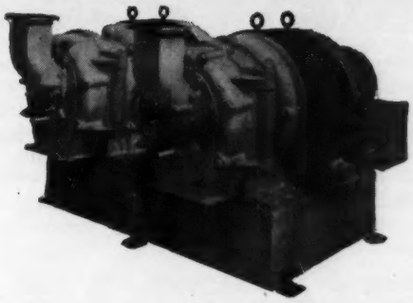

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BOOKLETS, CATALOGS, etc.

Latex Foam. Rubber Development Bureau, 1631 K St., N. W., Washington 6, D. C. 6 x 9 in. 12 pp.

This booklet is a fact summary on latex foam containing data on what latex foam is, how it is made, its uses, advantages, supply and sources. The need for a booklet of this type became evident during the recent nation-wide market survey on latex foam conducted by the Rubber Development Bureau when it was learned that only 3 out of 10 people in the United States had ever heard of latex foam and only 1 out of 12 owned any latex foam product. The current booklet is the first step in a carefully designed program to educate people to the nature of latex foam, its advantages and widespread application in the cushioning field.

•

Hercules Products. Hercules Powder Co., Wilmington, Del. 8½ x 11 in. 20 pp.

Approximately one hundred chemicals are described in this booklet which classifies all of the company's chemicals by family groups. Included among the products listed for the first time are Abitol, hydroabiety alcohol; Toxaphene, chlorinated camphene, agricultural insecticide poison; dried whey; Cellolyns, a series of resins especially designed for lacquers; Dresinols, a series of resin emulsions containing 40 to 45 per cent solids; and other new resins from rosin. The family classifications into which products are divided are cellulose, synthetic resins, rosin, terpene solvents and chemicals, chlorinated products, dairy products, and explosives and sporting powders. All of the products listed are briefly described as to chemical makeup, uses and potential applications.

•

Titeflex All-Metal Flexible Hose. (Catalog No. 113). Titeflex, Inc., 500 Frelinghuysen Avenue, Newark 5, N. J. 8 x 11 in. 24 pp.

The company's all-metal flexible tubing is described and illustrated in this catalog. In addition to Titeflex brass tubing, the catalog describes the company's new bronze tubing for nominal steam pressure applications, monel and stainless steel tubing for higher temperatures and corrosion resistance, and inconel tubing for extremely high temperatures. Included are specifications for standard fittings and illustrations of typical assemblies for these fittings. Bendable pipe, high frequency conductors and vibration eliminators are also described.

Fig. 47. Biggs vulcanizer with special heating manifolds and circulating fan; all sizes, various working pressures.

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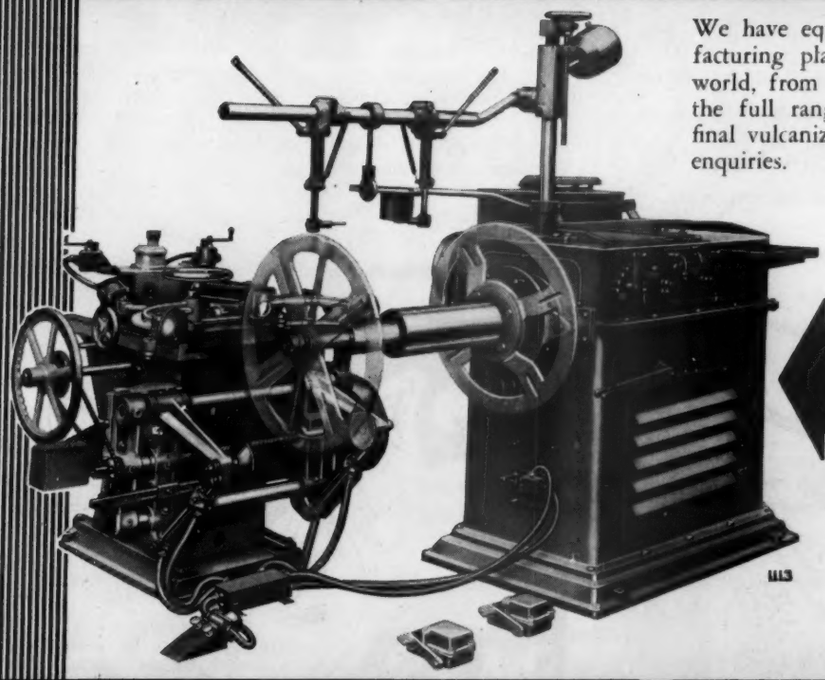

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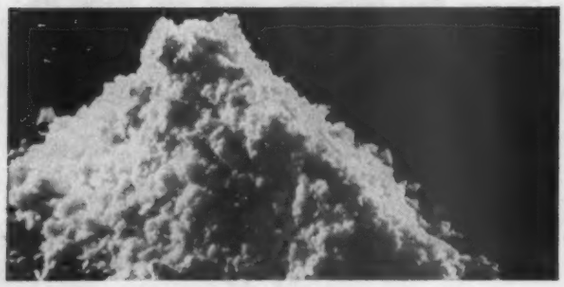

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REVIEWS (CONT'D)

How to Select The Right Oven For Your Process. Gehnrich & Gehnrich, Inc., 32-32 57th St., Woodside, L. I., N. Y. 6 x 9 in. 32 pp.

This manual discusses the four basically different types of oven heating systems; when to use which; the different heating media; temperature and safety control; insulation; the material-handling problem; interesting ingenuities; the action of different products under heat (chemically, physically, metallurgically, structurally); and the seven basic oven and heater types Liberally illustrated, the manual contains 43 drawings and diagrams, 23 photographs, 7 oven selection tables, and numerous definitions and listings.

•

On Pilot Plants and the Synthesizing Process Pilot Plant. Patterson Foundry & Machine Co., East Liverpool, Ohio. 5 x 8 in. 8 pp.

Construction and use of the Patterson synthesizing process pilot plant, designed for the production of a wide variety of products, is discussed in detail in this booklet. Distillation and purification of many high boiling solvents, plasticizers and alcohols, polymerization of urea, phenolics, and alkyd, vinyl and other types of synthetic resins, and thermal-plastic and soluble resin processes as carried out in the pilot unit are discussed.

•

Anniversary in Ambler. Keasbey & Mattison Co., Ambler, Penna. 6 x 9 in. 16 pp.

Explaining the first use of asbestos by the Greeks back in 450 B.C., and tracing the development of the mineral, this booklet has been published by the company on the occasion of its 75th anniversary. It stresses the important contributions by the company, one of the pioneer makers of asbestos and magnesia products. Tribute is paid to the late Henry G. Keasbey and Richard V. Mattison, who started the business as a small pharmaceutical laboratory in Philadelphia, Penna., in 1873.

•

Butch Learned the Hard Way. (Bulletin No. 95). U. S. Department of Labor, Bureau of Labor Standards, Washington 25, D. C. 4 x 5½ in. 16 pp.

A safety guide for workers in all types of industrial plants, this pocket-size pamphlet discusses such basic essentials as wearing protective clothing, using the machine guards provided, practicing good housekeeping, promptly reporting defective equipment, eliminating horseplay while on the job, and seeking first aid for even minor injuries. The pamphlet is the first of a series to appear in the coming months heralding the President's National Conference on Industrial Safety.

FOR FURTHER DETAILS, SEE AD ON PAGE 278

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MARKETS

Rubber – Crude, Reclaimed and Scrap – Cotton – Ducks – Tire Fabrics – Sheetings

NEW YORK, JUNE 11, 1948

Natural Rubber

The price of spot rubber on the Commodity Exchange has swung in a range of 1.50 cents since our last report (May 11), high for the period being 23.75 cents, reached on May 18, and low 22.25 cents on May 25. The average price of spot rubber for the month of May was 23.39 cents, based on 20 trading days. This compares with an average of 22.87 cents for April.

The uncertainty over developments during this period had a tendency to make for general cautiousness in trading in the futures market, and the result has been limited operations. While considerable activity took place in the market for actual rubber, the facilities of the Exchange were not used to any great extent.

The feeling persists that the labor unrest in the Far East will sooner or later play a dominant role in formulating the trend of rubber prices. Further influences upon the price situation were attributed to increased purchases by Russia, and record-breaking Malayan production.

World production of natural rubber, according to information received from the Secretariat of the Rubber Study Group in London, amounted to 127,500 long tons in April, bringing the total for the first four months of 1948 to 475,000 long tons. World stocks at the end of April amounted to 832,500 long tons, of which 240,000 long tons were in producing areas, 380,000 tons in consuming areas, and 212,500 tons were afloat.

Today's quotations in the outside market, London and Singapore, follow:

Outside Market

No. 1 Ribbed Smoked Sheets:	
Spot	.22¼
June	.22⅝
July-September	.22½
Thin Latex Crepe:	
Spot	.26¼
June	.26¼
Thin Brown Crepe, No. 2	.18⅜
Ambers, No. 3	.18⅜
Flat Bark Crepe	.12¼

London Market

(Standard Smoked Sheets)

July-September	23.03 - 23.24
October-December	22.02 - 22.13

Singapore Market

(Standard Smoked Sheets)

June	21.04 - 21.15

Synthetic Rubber

(Dry Types)

Butaprene NF	.390 - .415
Butaprene NL	.400 - .425
Butaprene NAA	.440 - .465
Butaprene NXM	.470 - .495
Chemigum 30 N4NS	.400 - .470
Chemigum 50 N4NS	.400 - .470
Chemigum N3	.450 - .520
Hycar OR-25	.400 - .425
Hycar OR-15	.470 - .495
Hycar OS-10	.400 - .425
Neoprene Type E	—— - .650
Neoprene Types CG and AC	—— - .500
Neoprene Types FR and KNR	—— - .750
Neoprene Type S	—— - .320
Neoprene Type NC	—— - .250
Perbunan 18	.390 - .415
Perbunan 26	.400 - .425
Perbunan 35	.470 - .495
Thiokol Type A	.370 - .470
Thiokol Type ST	.750 - .850
Thiokol Type FA	.520 - .620
Thiokol PR-1	.750 - .850

Scrap Rubber

There is still no activity in the scrap rubber field, and no change in the situation is anticipated for the next several months. Prices on several grades have been reduced since our last report. Current quotations follow:

(Prices to Consumers, Delivered Akron)

Mixed passenger tires	ton	$12.00
Beadless truck tires	ton	nom.
Mixed truck tires	ton.	12.00
Beadless passenger tires	ton	nom.
No. 1 passenger peelings	ton	42.50
No. 1 truck peelings	ton	42.50
Red passenger tubes	lb.	.06¼
Black passenger tubes	lb.	.03½
Mixed passenger tubes	lb.	.03¾
No. 2 truck tubes	lb.	nom.
Red truck tubes	lb.	.06
Black truck tubes	lb.	.03
Buffings	ton	15.00

Reclaimed Rubber

Although demand for reclaim continues fair, it was recently revealed that there is at present an overcapacity of reclaimed rubber facilities and that there is a large inventory on hand. Several reclaiming plants are reported to be operating on a four-day-a-week basis only. There has been no change in the price structure. Current quotations follow:

Tires			
Black, Acid	lb.	.08¾@	.09¼
Black, Digester	lb.	.08 @	.08½
Peels	lb.	.09 @	.09½
GR-S Whole Tire	lb.	.08½@	.09
Inner Tubes			
Black	lb.	.12¾@	.13¼
Red	lb.	.13½@	.14
GR-S	lb.	.09½@	.10
Butyl	lb.	.08½@	.09
Shoe			
Unwashed	lb.	.08¼@	.08¾

Cotton Tire Fabrics

Despite the forthcoming shut-downs for vacations, inventory ,etc., within the next few weeks, the demand for cotton tire fabrics has revived somewhat in the past few weeks. Some of the smaller tire manufacturers have finally begun production on the new low pressure tires, which is partially responsible for the renewed demand. There has been no change in the price structure. Current quotations follow:

Standard, Peeler, 12/4/2	lb.	.7600
Standard, Peeler, 14/4/2	lb.	.7800
Standard, Peeler, 16/4/3	lb.	.8050
Extra Staple, Peeler, 12/4/2	lb.	.8575
Extra Staple, Peeler, 14/4/2	lb.	.8775
Extra Staple, Peeler, 16/4/3	lb.	.9025

Chafers

14.4 oz. (per sq. yard)	lb.	.7550
9.25 oz. (per sq. yard)	lb.	.7125
11.65 oz. (per sq. yard)	lb.	.6850
8.9 oz. (per sq. yard)	lb.	.7275

Cotton

The price of middling uplands on the Cotton Exchange has swung in a range of .99 cents since our last report (May 11), high for the period being 39.14 cents on May 15, and low 38.23 cents on June 11. The average price of middling uplands for the month of May was 38.57 cents based on 24 trading days. This compares with an average of 38.10 cents for the month of April.

The New York Cotton Exchange service estimates cotton consumption during May at 770,000 bales compared with 830,000 in April and 808,000 in May a year ago. The daily rate in May, 1948, was about 37,100 bales against 37,100 bales in May a year ago. If confirmed by the Census Bureau the May consumption would bring the 10 months' total to 7,901,046 bales against 8,617,619 bales last year.

Russo-Pakistan relations are gradually assuming a tangible form, with Soviet Russia for the first time in her history undertaking to supply cotton textile and cotton ginning plants for Pakistan. Recently Russia purchased 70,000 bales of raw cotton in Pakistan which according to Soviet experts has a finer fiber than Egyptian cotton. The Soviet will supply its own ginning plants soon in Pakistan for experimental purposes. Russia will also supply cloth in exchange for cotton at moderate rates.

The cotton trade has revised its estimate of cotton acreage, and it is expected that 24,000,000 acres will be planted. If the acreage is confirmed, and the yield per acre were to break or equal previous records of 300 pounds per acre, the crop would be 15,000,000 bales.

Quotations for middling uplands on the Exchange follow:

	May 11 Close	June 11 High	June 11 Low	June 11 Close
July	37.07	36.54	36.27	36.42
October	33.76	33.10	32.95	33.03
December	33.08	32.55	32.40	32.46

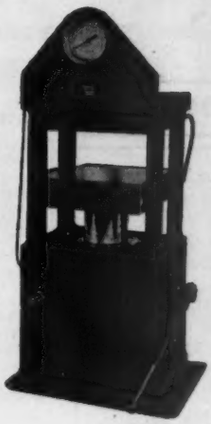
Closing Rubber Prices on New York Commodity Exchange

FROM MAY 12 TO JUNE 11

Date	Spot	July	Sept.	Dec.	Mar.	Sales
May 12	23.50	21.84	21.30	21.18	21.18	44
13	23.50	21.80	21.29	21.14	21.14	24
14	23.62	22.06	21.60	21.36	21.36	80
15	——	——	——	——	——	——
16	——	——	——	——	——	——
17	23.62	22.20	21.65	21.40	21.40	15
18	23.75	22.40	21.80	21.50	21.50	114
19	23.75	22.35	21.75	21.50	21.50	54
20	23.62	22.25	21.75	21.59	21.59	53
21	23.37	22.00	21.70	21.35	21.35	140
22	——	——	——	——	——	——
23	——	——	——	——	——	——
24	23.00	21.50	21.20	20.98	20.98	218
25	22.25	21.65	21.50	21.15	21.15	215
26	22.62	21.90	21.70	21.40	21.40	369
27	22.75	21.85	21.65	21.15	21.40	50
28	22.75	21.85	21.65	21.51	21.30	55
29	——	——	——	——	——	——
30	——	——	——	——	——	——
31	——	——	——	——	——	——
June 1	22.75	22.07	21.87	21.77	21.62	88
2	22.75	22.00	21.90	21.70	21.55	89
3	22.62	21.75	21.70	21.53	21.45	65
4	22.50	21.75	21.50	21.35	21.10	54
5	——	——	——	——	——	——
6	——	——	——	——	——	——
7	22.50	21.75	21.75	21.57	21.20	63
8	22.62	21.90	21.90	21.75	21.50	56
9	22.75	22.00	22.00	21.75	21.40	13
10	22.62	21.65	21.80	21.70	21.40	89
11	22.75	21.90	21.99	21.80	21.45	81

HOT PLATE MOLDING PRESS
Engineered for Rubber and Plastics

- **Low Cost Operation**
- **Self-Contained**
- **Sturdily Built**
- **Prompt Delivery**



The M & N 30 ton electric hot plate molding press is specially designed for the rubber and plastics industries where speed and ease of operation are essential to low cost production. It is readily adapted for production runs or laboratory control work.

Available with any number of openings. Steam heated or electric platens available at slight cost. Larger platens and motor-driven hydraulic power units are also available. Features of this M & N press include the visual ture indicator, dual pressure hand pump, electrically heated and thermostatically controlled platens, all steel construction, and large platen areas.

SPECIFICATIONS

SIZE OF BASE	16" x 12"	DAYLIGHT OPENING	10"
OVERALL HEIGHT	42"	STROKE	6"
PLATEN SIZE	12" x 12"	RAM DIAMETER	5"
CAPACITY	30 tons	APPROX. WEIGHT	400 lbs.

HYDRAULICS DIVISION

M & N MACHINE TOOL WORKS, Inc.

148 Orono Street — Clifton, N. J.

HOGGSON BRAND Since 1849

NEW!

ELECTRICALLY HEATED FLAT FACE ROLL

For Rubber and Plastics Shops

Designed Primarily for seaming rubber, but is also efficient for forming, rolling or flattening unvulcanized rubber and plastics. Steel roll, size 1½" x 1½". Heats quickly (A.C. or D.C.) to an effective heat level for working these products. Well made throughout for factory use. Has 5½ feet of cord, high grade, hard rubber switch, and combination prong plug; but this can be varied to your need. Write for prices.

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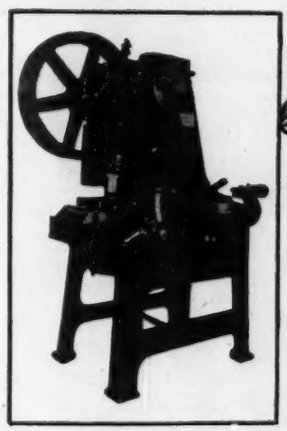
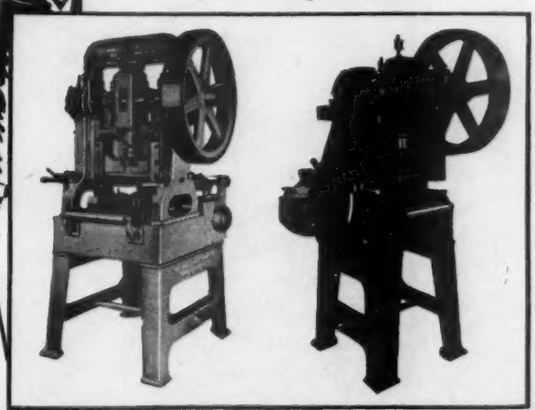
PROVEN...BY COUNTLESS NEW USERS

COULTER
RUBBER CUTTING MACHINES

NEW Proven features for continuous volumetric control and stripping for HEELS-SOLES-TAPS and other molded products.



MODEL A-1



MODEL A-2 MODEL A-3

- Model A-1 For HEELS at high speed production, or short runs.
- Model A-2 For Multiple HEELS, HALF and FULL SOLES with stock grain.
- Model A-2S (Not Illustrated) For cutting crosswise of grain of stock.
- Model A-3 For Multiple HEELS and TAPS with or across stock grain.

Here is the *Rubber Cutting Machine* that will *cut with* or across the stock grain, either singular or in multiples—from a strip of stock direct from the warming mill.

WRITE FOR FULL PARTICULARS

Production Machines Since 1896

The James **COULTER** *Machine Co.*

BRIDGEPORT • CONNECTICUT • U.S.A.

CURRENT MARKET PRICES

Of Rubber Chemicals and Compounding Ingredients

JUNE 11, 1948

Prices are, in general, f.o.b. works. Range of prices indicates grade or quantity variations.

Abbreviations: bbls., barrels; c.l., carlot; cyl., cylinder; dlvd., delivered; dms., drums; l.c.l., less than carlot; M.B., masterbatch; min., minimum; ref., refined; sap., saponified; sp., special; syn., synthetic; t.c., tank cars.

—The arrangement of this section follows closely the Chemical Section of the 1947 RUBBER RED BOOK to which readers are referred to determine the classification of any material or brand name.
—Although suppliers of every material were contacted for price information, only those materials are listed for which quotations have been furnished us. The quotations are not guaranteed and prospective purchasers should contact suppliers for confirmation before placing orders. Suppliers are requested to send us regularly current prices on all of their materials used in the rubber industry.
—All requests for information or listings should be sent to Market Editor, RUBBER AGE, 250 West 57th St., New York 19, N. Y.

ACCELERATORS

A-1	lb.	.34	.39
A-10	lb.	.40	.47
A-19	lb.	.52	.58
A-32	lb.	.59	.69
A-77	lb.	.42	.55
A-100	lb.	.42	.55
Accelerator No. 8 (dlvd.)	lb.	——	.75
Accelerator No. 49	lb.	.44	.45
Accelerator No. 89 (dlvd.)	lb.	——	1.20
Accelerator No. 122 (dlvd.)	lb.	——	1.30
Accelerator No. 552 (dlvd.)	lb.	——	1.63
Accelerator No. 808 (dlvd.)	lb.	.59	.61
Accelerator No. 833 (dlvd.)	lb.	1.13	1.15
Acrin (dlvd.)	lb.	——	.65
Advan	lb.	.52	.55
Altax	lb.	.35	.37
Arazate	lb.	——	2.16
Beutene	lb.	.59	.64
B-J-F	lb.	.27	.32
Butasan	lb.	——	1.10
Butazate	lb.	——	1.00
Butyl Eight	lb.	1.00	1.05
Captax	lb.	.27	.29
C-P-B	lb.	——	1.95
Cumate	lb.	——	1.45
Cuprax	lb.	.60	.62
Dibenzo G-M-F	lb.	——	2.65
Diorthotolylguanidine (dlvd.)	lb.	.48	.50
Diphenylguanidine (dlvd.)	lb.	.39	.40
El-Sixty	lb.	.39	.46
Ethasan	lb.	——	1.10
Ethazate	lb.	——	1.00
Ethyl Thiurad	lb.	——	1.25
Ethyl Tuex	lb.	——	1.00
Formaniline (dlvd.)	lb.	——	.40
G-M-F	lb.	——	2.50
Good-rite Erie	lb.	.53	.55
Guantal	lb.	.43	.50
Hepteen	lb.	.42	.48
Base	lb.	1.80	1.90
Ledate	lb.	——	1.00
Mercaptobenzothiazole	lb.	.27	.32
Mercaptobenzothiazyl Disulfide	lb.	.35	.40
Methasan	lb.	——	1.20
Methazate	lb.	——	1.00
Monex	lb.	——	1.10
Mono Thiurad	lb.	——	1.25
Morfex 33	lb.	.53	.58
2-MT (dlvd.)	lb.	.58	.60
Novac	lb.	——	1.40
A-13	lb.	.65	.67
O-X-A-F	lb.	.34	.39
Pentex	lb.	.74	.78
Flour	lb.	.12¼	.13¼
Phenex (tons)	lb.	——	.40
Pipazate	lb.	——	1.53
Pip-Pip	lb.	——	1.63
R-2 Crystals	lb.	——	1.55
Rotax	lb.	.39	.41
SA 52	lb.	——	1.10
SA 57	lb.	——	1.00
SA 62	lb.	——	1.00
SA 66	lb.	——	1.45
SA 67	lb.	——	1.00
SA 77	lb.	——	1.00
Safex	lb.	——	1.15
Santocure	lb.	.53	.60
Selazate	lb.	——	1.45
Selenac (Ethyl, Methyl)	lb.	——	1.45
Setsit-5	lb.	.75	1.00
SPDX-G (tons)	lb.	——	.59
Tellurac	lb.	——	1.45
Tepidone (dlvd.)	lb.	——	.55
Tetrone (dlvd.)	lb.	——	1.25
A (dlvd.)	lb.	——	1.85
Thiocarbanilide (dlvd.)	lb.	——	.34
Thiofide	lb.	.35	.42
Thionex (dlvd.)	lb.	——	1.10
Thiotax	lb.	.27	.34
Thiurad	lb.	——	1.25
Thiuram E (and M) (dlvd.)	lb.	1.00	1.10
Trimene	lb.	.54	.64
Base	lb.	1.03	1.18
Triphenylguanidine (dlvd.)	lb.	——	.50
Tuads (Ethyl, Methyl)	lb.	1.00	1.10
Tuex	lb.	——	1.10
Ultex (tons)	lb.	——	1.23
Vreka	lb.	.55	.62
Blend B	lb.	.55	.62
C	lb.	.52	.59
Vulcanex (dlvd.)	lb.	——	.45
Z-B-X	lb.	——	2.45
Zenite (dlvd.)	lb.	.33	.35
A (dlvd.)	lb.	.42	.44
B (dlvd.)	lb.	.39	.41
Zenite Special	lb.	.34	.36
Zimate (Butyl, Ethyl)	lb.	——	1.00
Zimate, Methyl	lb.	——	1.00

ACTIVATORS

Blue Lead, Sublimed (dlvd.)	lb.	.15¼	.15½
Fish Oil, Hydrogenated, Fatty Acid			
Hydrofol Acid (dlvd.)	lb.	.28¼	.31¾
Hyfac 430 (dlvd.)	lb.	.28½	.29½
Neo-Fat H.F.O. (dlvd.)	lb.	.33	.34
Stearex Beads (dlvd.)	lb.	.28	.29½
Lime, Hydrated			
Arrowhead	ton	16.00	19.50
Sierra	ton	16.00	19.50
Litharge			
Eagle (dlvd.)	lb.	.166	.176
FBS (dlvd.)	lb.	.166	.176
Magnesium Oxide, Heavy			
General Magnesite	lb.	.05½	.08
Michigan No. 15	lb.	.0550	.0600
Permanente	lb.	.05	.06½
Magnesium Oxide, Light			
Baker's (Neoprene Grade)	lb.	——	.28
General Magnesite (Neoprene Grade)	lb.	——	.28
General Magnesite No. 101	lb.	——	.175
General Magnesite Standard	lb.	——	.22
K & M	lb.	——	.28
Michigan No. 30	lb.	——	.22½
No. 40	lb.	——	.2800
Witco Extra Light	lb.	.25	.27
Oleic Acid			
Emersol 210 (dlvd.)	lb.	.23½	.25¾
L.C.P. Red Oil	lb.	.25½	.27¼
Red Oil (20-24 Saponified) (dlvd.)	lb.	.30½	.32¾
Palm Oil Fatty Acid (c.l.)	lb.	——	.11
Potassium Oleate (drums)	lb.	——	.29½
Red Lead			
No. 2 RM (dlvd.)	lb.	.181	.191
Sodium Laurate (drums)	lb.	——	.19
Sodium Oleate—Powder (drums)	lb.	——	.35
Paste (drums)	lb.	——	.20
Sodium Stearate—Powder (drums)	lb.	——	.35
USP Grade (drums)	lb.	——	.37
Stearic Acid, Single Pressed			
Emersol 110 (dlvd.)	lb.	.32	.33
Stearex B (dlvd.)	lb.	.31½	.32½

ACTIVATORS (Cont'd)

Stearic Acid, Double Pressed			
Alba (dlvd.)	lb.	.39¼	.41¾
S-2-A (dlvd.)	lb.	.37	.39½
S-2-B (dlvd.)	lb.	.36½	.39
Stearic Acid, Other			
Neo-Fat 1-60 (dlvd.)	lb.	.37½	.39
Neo-Fat 1-65 (dlvd.)	lb.	.38½	.39½
Stearite	cwt.	36.00	38.00
White Lead Carbonate (dlvd.)	lb.	.16	.16½
Zinc Laurate (c.l.)	lb.	——	.29
Laurex	lb.	.32	.35
Zinc Stearate	lb.	.51	.52
Aquazinc	lb.	.20	.35

Unclassified Activators

Actifat (dms.)	lb.	——	.18
Acidex	lb.	.19	.32
Aero Ac 50	lb.	.50	.56
165	lb.	.37	.39
Barak (dlvd.)	lb.	——	.60
D-B-A	lb.	——	1.95
Delac J	lb.	.55	.60
P	lb.	.45	.52
Dibutylamine No. 117 (l.c.l., dms.)	lb.	——	.69
Dutch Boy Normasal	lb.	——	.38¾
Palmalene (drums)	lb.	——	.15
Polyac (dlvd.)	lb.	——	1.40
Ridacto (drums)	lb.	.22	.24
Snodotte (dlvd.)	lb.	.30	.31
SOAC (min. 10 dms.)	cwt.	——	12.00
Triamylamine No. 180 (l.c.l., drums)	lb.	——	1.01

ANTI-COAGULANTS

Anhydrous Ammonia (l.c.l.)	lb.	.02½	.02¾
National (cyl., dlvd.)	lb.	.16	.20
Aqua Ammonia (l.c.l., dms.)	lb.	——	.03
M.B.M. (l.c.l.)	lb.	——	.35

ANTI-FOAMING AGENTS

Aero Anti Foam H	lb.	——	.12
Regular	lb.	——	.08½

ANTI-OXIDANTS

Agerite Alba	lb.	2.20	2.30
Gel	lb.	.55	.57
Hipar	lb.	.76	.78
H. P.	lb.	.58	.60
Powder	lb.	.43	.45
Resin	lb.	.60	.62
Resin D	lb.	.43	.45
Stalite	lb.	.43	.45
White	lb.	1.35	1.45
Akroflex C (dlvd.)	lb.	.58	.60
Aminox	lb.	.43	.52
Aranox	lb.	——	2.15
Benzoquinone	lb.	1.50	1.75
Betanox Special	lb.	.61	.70
B-L-E	lb.	.43	.52
Powder	lb.	.61	.63
B-X-A	lb.	.43	.45
Carvacrol	lb.	——	.85
Chlorcarvacrol	lb.	——	2.45
Flectol H	lb.	.43	.50
Flexamine	lb.	.58	.61
Gallic Acid, Tech.	lb.	1.10	1.23
USP or NF	lb.	1.27	1.40
Hydroquinone	lb.	.90	.90
Monomethylparaminophenol Sulfate	lb.	2.40	2.90
Neozone Standard (dlvd.)	lb.	.66	.68
A (dlvd.)	lb.	.43	.45
C (dlvd.)	lb.	.47	.49
D (dlvd.)	lb.	.43	.45
Oxidex	lb.	——	3.40
Parazone (dlvd.)	lb.	——	.68
PDA-10	lb.	.37	.42
Perflectol	lb.	.58	.65
Permalux (dlvd.)	lb.	1.53	1.55
Pyrogallic Acid, Resublimed	lb.	2.60	2.65
USP Crystals	lb.	2.10	2.15
Resorcin, Tech. (dlvd.)	lb.	——	.64
Santoflex B	lb.	.43	.50
BX	lb.	.57	.64
Santovar-A	lb.	1.30	1.37
Santowhite	lb.	1.40	1.52
S.C.R. (tons)	lb.	——	.32
Solux (dlvd.)	lb.	1.93	1.95
Stabilite (tons)	lb.	——	.48
Alba (tons)	lb.	——	.69
L (tons)	lb.	——	.48

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HEmlock 2188

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Armour's 332 stock points mean fast, dependable service

U. S. P.... A chemically-pure, water-white glycerine, meeting all requirements of the U. S. Pharmacopoeia . . . for use in foods, pharmaceuticals, cosmetics or any purpose demanding highest quality. Specific gravity, 1.249—25° C./25° C.

HIGH GRAVITY... A pale yellow industrial glycerine. Specific gravity, 1.262—15.5° C./15.5° C.

DYNAMITE... Made especially for the explosives trade. Specific gravity, 1.262—15.5° C./15.5° C.

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Our products are engineered to fill every need in natural and synthetic rubber compounding wherever the use of vulcanized oil is indicated.

We point with pride not only to a complete line of solid Brown, White, "Neophax" and "Amberex" grades, but also our aqueous dispersions and hydro-carbon solutions of "Factice" for use in their appropriate compounds.

Continuing research and development in our laboratory and rigid production control has made us the leader in this field.

The services of our laboratory are at your disposal in solving your compounding problems.

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STAMFORD, CONN.
Makers of Stamford "Factice" Vulcanized Oil Since 1900
(REG. U. S. PAT. OFF.)

ANTI-OXIDANTS (Cont'd)

Tannic Acid, Tech.	lb.	.70	.79
Thermoflex (dlvd.)	lb.	1.48	1.50
A (dlvd.)	lb.	.76	.78
C (dlvd.)	lb.	.54	.56
Thymol	lb.	——	2.50
V-G-B	lb.	.43	.52

ANTI-SCORCHING AGENTS

Good-rite Vultrol	lb.	.55	.57
Retarder W (dlvd.)	lb.	——	.43
Salicylic Acid, Tech.	lb.	——	.38
Sodium Acetate 60-62% Crystals	lb.	——	.05½

ANTISEPTICS AND GERMICIDES

Formaldehyde (barrels)	lb.	——	.062
G-4	lb.	.95	2.50
G-11	lb.	3.50	5.50
Methyl Para Hydroxy Benzoate	lb.	——	1.50
Nuodex 100 SS (dlvd.)	lb.	——	1.50
Nuodex 100 W.O. (dlvd.)	lb.	——	1.80
Nuodex Zinc 8 (dms.) (dlvd.)	lb.	——	.19¾
Ortho Cresol (26°-27°)	lb.	——	.18
Sohgen Drier—Copper 8% (drums)	lb.	——	.21
Zinc 8% (dms.)	lb.	——	.19¾
Vancide	lb.	——	.80

AROMATICS (DEODORANTS)

Arolene 1980 (c.l.)	lb.	——	.10
2286	lb.	——	.25
2553 (c.l., dms.)	lb.	——	.13
Bouquet 149	lb.	——	3.00
Coumarin	lb.	——	2.75
Curodex 19	lb.	——	4.75
188	lb.	——	5.75
198	lb.	——	6.75
D-6 Masking Perfume	lb.	——	1.35
Deodorant 65	lb.	——	1.00
Deodorant L-37	lb.	2.00	2.40
L-44	lb.	2.50	2.90
N.L.T.X.	lb.	1.85	2.15
Latex Perfume 5	lb.	——	3.25
6	lb.	——	7.50
9	lb.	——	.65
Neutroleum Delta	lb.	——	2.40
Gamma	lb.	——	3.40
Parador A	lb.	2.00	2.50
B	lb.	.65	1.00
C	lb.	2.75	3.25
D	lb.	1.50	2.00
E	lb.	.25	.75
Perfume Oil Bouquet Vanilla M	lb.	2.40	2.75
Rodo No. 0	lb.	4.00	4.50
No. 10	lb.	5.00	5.50
Rubbarome (dms.)	lb.	1.10	2.10
Rubber Perfume 7	lb.	——	9.15
12	lb.	——	1.90
Russian Leather 7	lb.	——	4.10
Vanillin	lb.	3.00	3.15

BLOWING AGENTS

Ammonium Bicarbonate (dlvd.)	lb.	.06¾	.09¾
Blowing Agent CP-975	lb.	——	.50
Sodium Bicarbonate, U.S.P. (c.l., bags)	cwt.	——	1.85
Sponge Paste	lb.	——	.20
Unicel (dlvd.)	lb.	——	.60
ND (dlvd.)	lb.	——	1.00
Urea	ton	73.00	90.00

BONDING AGENTS

Durez 12987	lb.	.48	.53
Interlake Resin No. 4162	lb.	——	1.50
MDI	lb.	7.25	7.75
50	lb.	3.60	3.85
Reanite	gal.	6.75	7.25
Rex Compound 482	gal.	——	1.05
Ty-Ply Q (and S)	gal.	6.75	8.00

COAGULANTS

Acetic Acid—56% (bbls.)	cwt.	8.11	8.61
Glacial—99½% (bbls.)	cwt.	14.05	14.55
Calcium Nitrate, Tech.., Crystals	lb.	.12½	.15
Hydroxyacetic Acid—70% (dms.)	lb.	.059	.084
Zinc Nitrate, Tech.	lb.	——	.21½

COLORING AGENTS

Black

Carbon Black—See *Reinforcing Agents*			
Aquablak B (also M, R)	lb.	.08¾	.09¼
Aquablak S	lb.	.07¾	.08¾
Lampblack No. 10	lb.	.06	.09
Mapico Black Iron Oxide (50 lb. bags)	lb.	.0975	.1000
Raven Black Pure Iron Oxide	cwt.	10.75	11.00

Blue

Blue GD, Dispersed (dlvd.)	lb.	——	3.95
Paste (dlvd.)	lb.	——	1.80
Blue N (dlvd.)	lb.	——	.94½
Blue YD, Dispersed (dlvd.)	lb.	——	2.50
Milori Blue 11840 (dlvd.)	lb.	——	.42
Monastral Fast Blue CP (dlvd.)	lb.	——	3.85
PCD, Dispersed (dlvd.)	lb.	——	2.50
Ramapo Blue	lb.	3.40	3.45
Rubber Blue X-1999	lb.	——	1.00
Stan-Tone Blue	lb.	1.40	4.00
Ultramarine	lb.	.14	.30
Vansul Blue M.B.	lb.	1.00	2.45
Victoria Blue BP-262-D	lb.	2.25	2.30

Brown

Brown Iron Oxide	lb.	——	.10
Mapico Brown (50 lb. bags)	lb.	——	.1250

Green

Filo Green D-700 (and D-705)	lb.	——	.30
Green Chromium Oxide, Pure	cwt.	31.50	38.50
Green Chromium Oxide, Pure, Hydrated	lb.	75.00	100.00
Green FD, Dispersed (dlvd.)	lb.	——	1.50
Monastral Fast Green GSD, Dispersed (dlvd.)	lb.	——	3.20
GSD Paste (dlvd.)	lb.	——	1.10
Permansa Green CP-594	lb.	——	1.35
Pigment Green B	lb.	——	1.50
GL-652D	lb.	.88	.93
Ramapo Green	lb.	4.00	4.05
Rubber Green X-1292	lb.	——	1.00
Stan-Tone Green	lb.	1.50	3.30
Utility Green	lb.	——	.30
Vansul Green M.B.	lb.	.85	2.35

Maroon

Stan-Tone Maroon	lb.	2.50	2.55
Vansul Maroon M.B.	lb.	2.45	2.60

Orange

Molybdate Orange	lb.	——	.41
Orange F (dlvd.)	lb.	——	3.65
FD, Dispersed (dlvd.)	lb.	——	2.75
Rubber Orange X-2065	lb.	——	2.60
Stan-Tone Orange	lb.	1.65	2.25
Vansul Orange M.B.	lb.	2.15	2.65

Red

Cadmium Red	lb.	.95	1.25
Cadmolith Red (bbls.)	lb.	1.10	1.35
Graphic Red (dlvd.)	lb.	——	.80
Indian Red, Pure	cwt.	11.50	11.75
Mapico Red 297 (50 lb. bags)	lb.	.1050	.1075
Oximony Iron Oxide	lb.	——	.09
Red Iron Oxide, Light	cwt.	11.50	11.75
Red PB (dlvd.)	lb.	——	1.90
PBD Dispersed (dlvd.)	lb.	——	1.65
2B (dlvd.)	lb.	——	1.75
2BD, Dispersed (dlvd.)	lb.	——	1.65
Rubanox Red CP-762 (dlvd.)	lb.	——	1.30
Rubber Red CP-339 (dlvd.)	lb.	——	1.05
Rubber Red RT-364	lb.	——	.75
Rubber Red RT-425	lb.	——	.75
Rubber Red X-1148	lb.	——	.75
Solfast Red CP-663 (dlvd.)	lb.	——	1.80
CP-787 (dlvd.)	lb.	——	1.30
Stan-Tone Red	lb.	1.10	1.55
Vansul Red M.B.	lb.	1.00	1.90
Watchung Red	lb.	——	1.90

White—Lithopone

Albalith	lb.	.06⅜	.06⅝
Astrolith	lb.	.06⅜	.06¾
Cryptone No. 19	lb.	.08¼	.08½
CB No. 21	lb.	.08	.08¼
Eagle	lb.	.06	.06¼
Permalith	lb.	.06	.06¼
Ponolith	lb.	.06⅜	.06¾
Sunolith	lb.	.06⅜	.06¾

White—Titanium Pigments

Rayox	lb.	.17½	.20½
Ti-Cal	lb.	.07	.07½
Ti-Pure	lb.	.20	.21
Titanox A—all grades (dlvd.)	lb.	.17½	.18
B-30 (dlvd.)	lb.	.07	.07½
C (dlvd.)	lb.	.06¾	.07¼
RA—all grades (dlvd.)	lb.	.19½	.20
RC-HT (dlvd.)	lb.	.06¾	.07¼
Zopaque	lb.	.17½	.18½

White—Zinc Oxide (American Process)

AZO-ZZZ 11 (and 22, 33, 44, 55)	lb.	.1100	.1125
Eagle	lb.	.1100	.1125
Horse Head Special	lb.	.1100	.1125
XX Red	lb.	.1100	.1125
Joxite	lb.	.0925	.0975
St. Joe Black Label	lb.	.1100	.1125
Green Label	lb.	.1100	.1125
Red Label	lb.	.1100	.1125

White—Zinc Oxide (Dispersed)

Dispersed Zinc Oxide	lb.	——	.13

White—Zinc Oxide (Fresh Process)

AZO-ZZZ 66	lb.	.1325	.1350
Eagle Green Seal	lb.	.1275	.1300
Eagle Red Seal	lb.	.1225	.1250
Eagle White Seal	lb.	.1325	.1350
Florence Green Seal	lb.	.1275	.1300
Red Seal	lb.	.1225	.1250
White Seal	lb.	.1325	.1350
Kadox 25	lb.	.1325	.1350
72	lb.	.1100	.1125
Black Label	lb.	.1100	.1125
Red Label	lb.	.1100	.1125
U. S. P. 12	lb.	.1425	.1450

White—Zinc Sulfide

Cryptone ZS-800	lb.	.1150	.1175

Yellow

Anchor Brand Pure Iron Oxide	cwt.	9.00	9.25
Cadmolith Yellow (bbls.)	lb.	——	.85
Chrome Yellow	lb.	——	.2950
Chrome Yellow 12310	lb.	——	.2950
Ferrox	cwt.	7.50	8.50
Mapico Yellow (50 lb. bags)	lb.	.0825	.0850
Rubber Yellow X-1940	lb.	——	1.60
Stan-Tone Yellow	lb.	1.20	1.75
Toluidine Yellow	lb.	——	1.70
YL-556-D	lb.	——	.82
Oximony Iron Oxide	lb.	——	.06¾
Vansul Yellow M.B.	lb.	.85	1.00
Yellow G (dlvd.)	lb.	——	1.95
GD, Dispersed (dlvd.)	lb.	——	1.85
HN (dlvd.)	lb.	——	1.60
Zinc Yellow	lb.	——	.21

DISPERSING AGENTS

Agchem SA-19	lb.	——	.30
SA-20	lb.	——	.70
Aquasol-AR 90%	lb.	——	.14½
Beaconol 52	lb.	.60	.75
Darvan No. 1 (and No. 2)	lb.	.30	.40
Daxad 11 (21, 23)	lb.	.07	.35
Dilex	lb.	——	.32
Dispersaid	lb.	1.25	1.35
Halloid	lb.	.03¾	.09½
HornKem No. 1	gal.	——	1.60
No. 3G	gal.	——	1.75
No. 12	lb.	——	.17
Marasperse CB	lb.	.11½	.15
N	lb.	.09	.10
Ramol PW	lb.	.18	.19
Rubbex	lb.	——	.27½
Stan-Chem BQC	lb.	.12¼	.17¼
1067	lb.	——	.13½
1471	lb.	.1687	.2187
2251	lb.	.12¼	.17¼
Triethanolamine (drums) (dlvd.)	lb.	.21½	.22½
Triton R-100	lb.	.15½	.25
Yelkin TT	lb.	——	.22
Zinsper	lb.	——	.15

EXTENDERS

Advagum 1098	lb.	——	.65
Bunaweld Polymer No. 780	lb.	——	.22
No. 5514	lb.	——	.30
D-92 (and D-93) (dms.)	lb.	——	.12
Extender 600	lb.	——	.208
PR-162 Latex (dms.)	gal.	1.00	1.60
Synprolac	lb.	——	.19
Synprowax	lb.	.16	.19
Vistanex	lb.	——	.32

FILLERS (Inert and Reinforcing)

Abrasives			
Carbonite	lb.	.15	.95
Lionite	lb.	.09¾	.90
Pumice	lb.	.03	.05
Aluminum Hydrate	lb.	——	.17
Aluminum Silicate			
Silical	ton	37.00	55.00
Marter White	ton	20.50	30.00
Barium Carbonate (l.c.l.)	ton	77.00	85.00
Barytes			
No. 1 Floated, White	ton	33.10	44.55
No. 2 Floated, Unbleached	ton	31.10	41.95
No. 22 Barytes (c.l.)	ton	——	18.37
Foam A	ton	——	30.10
Bentonite (c.l.)	ton	——	11.00
SPV Volclay (c.l.)	ton	——	11.00
Blanc Fixe	ton	72.50	120.00
Calcium Carbonate			
Atomite (c.l.)	ton	——	30.00
B.I. White No. 1 (c.l.)	ton	——	7.50
B.I. White No. 2 (c.l.)	ton	——	7.00
Blue-Star XX	ton	——	15.00
Calcene T	ton	40.00	50.00
Camelwite	ton	——	30.00
Kalite (c.l.)	ton	——	40.00
Lesamite (c.l.)	ton	——	27.50
Lim-Cal (c.l.)	ton	——	12.50
Millical (c.l.)	ton	——	25.00
Multifex	ton	——	105.00
Sierracal	ton	15.00	18.50
Super Multifex	ton	——	145.00
Suspenso (c.l.)	ton	——	22.00
Swansdown (c.l.)	ton	——	20.00
Witcarb R (c.l.)	ton	——	105.00
R-12 (c.l.)	ton	40.00	60.00

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FILLERS (Cont'd)

Calcium Silicate			
Silene EF	ton	110.00	-120.00
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Snow White Filler	ton	——	- 17.00
Calcium Sulfate, Hydrous			
Crysta-Cal (c.l.)	ton	——	- 12.50
Terra Alba No. 1	ton	12.00	- 14.40
Chalk Whiting (l.c.l.)	lb.	.0150	- .0175
Recco Paris Whiting	ton	——	- 26.00
Clay			
Alsite (c.l.)	ton	——	- 13.00
Aluminum Flake	ton	16.50	- 60.00
A.S.P. No. 1 (c.l.)	ton	——	- 35.00
No. 11 (c.l.)	ton	——	- 40.00
Buca (c.l.)	ton	——	- 44.00
Catalpo (c.l.)	ton	——	- 33.00
Champion	ton	——	- 13.00
C.S.D. (c.l.)	ton	——	- 12.00
Crown	ton	——	- 13.00
Dixie (c.l.)	ton	——	- 29.50
Hydratex R	ton	28.00	- 40.00
Kaolloid Clay (c.l.)	ton	——	- 10.50
Markham (c.l.)	ton	——	- 13.00
McNamee (c.l.)	ton	——	- 29.00
Oldham (c.l.)	ton	——	- 13.00
Paragon	ton	12.50	- 27.20
Recco (c.l.)	ton	——	- 13.00
Stellar-R	ton	——	- 50.00
Suprex	ton	13.00	- 27.70
Upton	ton	19.50	- 21.00
Whitetex (c.l.)	ton	——	- 50.00
Witco No. 1 (c.l.)	ton	13.00	- 33.00
No. 2 (c.l.)	ton	13.00	- 33.00
Diatomaceous Earth	ton	30.00	- 50.00
Kaylorite (c.l.)	ton	——	- 30.00
Dolomite (c.l.)	ton	11.00	- 12.00
Flock			
Cotton	lb.	.08½	- .20
Filfloc F 40-9000	lb.	——	- .16
Filfloc F 6000	lb.	——	- .22
Rayon, bleached or dyed	lb.	.85	- 1.50
Rayon, grey	lb.	——	- .18
Solka-Floc (l.c.l.)	lb.	.05	- .12
Wool, bleached or dyed	lb.	.70	- 1.00
Glue, Bone (dlvd.)	lb.	.16½	- .18½
Graphite	lb.	.05	- .20
Ground Glass (l.c.l.)	lb.	.04	- .06
Leather, Shredded	lb.	.05	- .17
Lignin	lb.	.03	- .06
Indulin	lb.	——	- .09
Limestone, Pulverized	ton	3.25	- 10.00
Micro Velva	ton	30.00	- 32.00
Velvet Filler, Regular	ton	16.00	- 18.00
Magnesium Carbonate	lb.	.08	- .09
Clearcarb	lb.	.10¾	- .11¼
K & M	lb.	.08	- .09
Magnesium Oxide	lb.	.05	- .06
Magnesium Silicate	ton	18.00	- 35.00
Airex	ton	22.50	- 23.50
Asbestol	ton	17.00	- 25.00
Blue Star Talc	ton	——	- 23.00
L.S. Silver	ton	24.50	- 26.50
Sierra White	ton	20.75	- 22.75
Mica	lb.	.01¼	- .07¾
Concord	lb.	.07	- .07¾
Micro-Mica	lb.	.06¾	- .07½
Mineralite (c.l.)	ton	30.00	- 40.00
Silversheen	lb.	.06½	- .07
Triple A Mica (c.l.)	ton	——	- 25.00
Wet Ground Biotite Mica	lb.	.05½	- .06¾
Wet Ground Mica No. 160	lb.	.06¾	- .07½
Mineral Black			
Keystone 126	ton	——	- 13.00
Pyrophyllite			
Pyrax A (c.l.)	ton	——	- 30.00
WA (c.l.)	ton	——	- 31.50
Silica	ton	16.00	- 27.00
Blue Star	ton	——	- 21.50
Slate, Powdered (l.c.l.)	ton	15.00	- 20.00
Talc, Domestic	ton	9.00	- 20.00
Walnut Shell Flour	ton	38.00	- 80.00
Whiting, Commercial	ton	8.00	- 20.00
Cameline (c.l.)	ton	8.50	- 10.00
C-C-O White	ton	——	- 14.50
Keystone (c.l.)	ton	——	- 16.00
Rambo No. 1 White	ton	——	- 9.00
Snowflake (c.l.)	ton	——	- 18.00
Veroc (c.l.)	ton	——	- 8.50
York White (c.l.)	ton	——	- 9.00
Wood Flour	ton	20.00	- 62.18

FINISHING MATERIALS, SURFACE

Beaco Finishes	gal.	1.05	- 1.35
Black Out	gal.	4.50	- 8.00
Shellac, Orange Gum	lb.	.60	- .80
VanWax	gal.	1.25	- 1.30

FLAME RETARDANTS

Chlorinated Paraffin	lb.	.10	- .25
Halowax	lb.	.24	- .30
Zinc Borate 3167	lb.	.12	- .16¾
Zyrox	lb.	.71	- .79

LUBRICANTS, MOLD

Aquadag	lb.	3.15	- 3.45
Aquarex BBX Conc. (dlvd.)	lb.	——	- .78
D (dlvd.)	lb.	——	- .76
L Paste (dlvd.)	lb.	——	- .85
MDL Paste (dlvd.)	lb.	——	- .30
Borax, Granular (l.c.l.)	ton	70.00	- 80.00
Colite Concentrate (dms.)	gal.	——	- .90

LUBRICANTS, MOLD (Cont'd)

Concentrex	lb.	——	- .20
Dipex	lb.	.14	- .18
Dri-Lube	lb.	——	- .18
Erlen Mold Lubricant	gal.	1.25	- 1.50
Glycerized Lubricant	gal.	——	- 1.85
Glydag	lb.	1.30	- 2.00
Kokobace	lb.	——	- .12
Latex-Lube (dlvd.)	lb.	——	- .22¾
Liqui-Lube (dlvd.)	lb.	——	- .16¾
Lubrex	lb.	.25	- .30
Migralube	lb.	——	- .30
Moldex	lb.	——	- .12½
Moldeze No. 1	gal.	——	- 36.00
No. 2	gal.	——	- 10.00
No. 3	gal.	——	- 25.00
Mold Lubricant No. 72 Conc.	gal.	1.25	- 2.75
Mold-Slick	lb.	.202	- .215
Orvus WA Paste (dms.)	lb.	——	- .25
Prodag	lb.	.25	- .38
Redotex Flakes (dlvd.)	lb.	.22⅜	- .22⅞
Powder (dlvd.)	lb.	.22⅞	- .23⅜
Rubber-Flo	gal.	——	- 1.15
Rubber-Glo	gal.	——	- .94
Rusco Mold Paste	lb.	——	- .18
Sericite (l.c.l.)	ton	65.00	- 75.00
Thermolube	lb.	——	- .11
Ulco Mold Soap	lb.	.16	- .29
Werkrite Flakes (dlvd.)	lb.	.19⅜	- .19⅞
Powder (dlvd.)	lb.	.20⅜	- .20⅞

LUBRICANTS, RUBBER

Lithium Stearate	lb.	.75	- .77
Propylene Stearate (drums)	lb.	——	- .40
Rubberol	lb.	——	- .3150

LUBRICANTS, RUBBER SURFACE

Barium Stearate	lb.	.48	- .49
Calcium Stearate	lb.	.45	- .47
Orel	gal.	1.85	- 2.00
Polyethylene Glycol	lb.	.25	- .26
Rexanol A	lb.	——	- .11
Separex A	lb.	——	- .15
Zinc Stearate	lb.	.48	- .49

MOLD CLEANERS

Actusol (dlvd.)	gal.	——	- 1.45
Metso 99	cwt.	3.05	- 4.45
Granular	cwt.	2.50	- 3.55
Rubber-Sol	gal.	——	- 1.89
Shelblast	ton	80.00	-140.00
Sodium Silicate	cwt.	.80	- 1.40
Sprex A.C. (dlvd.)	lb.	——	- .15½

PEPTIZING AGENTS

Peptizer P-12	lb.	.84	- .90

PLASTICIZERS & SOFTENERS

AA (drums)	lb.	——	- .15¾
Acto 500	lb.	——	- .09
Adipol BCA (dms.)	lb.	.44½	- .45
Amalgamator Z-4	lb.	——	- .30
American Pine Tar	gal.	.34½	- .45½
Bardex	lb.	.05	- .05¼
Bardol	lb.	.02¾	- .03¾
B	lb.	.05½	- .05¾
Bayol D	gal.	.29½	- .31½
F	gal.	.46	- .49
Beeswax, Refined & Bleached	lb.	.64	- .74
Yellow Refined	lb.	.63½	- .68
Bondogen	lb.	.55	- .60
B.R.C. No. 20	lb.	.0125	- .0135
B.R.H. 2	lb.	.02	- .029
BRS 700	lb.	.0175	- .026
B.R.T. 3	lb.	.024	- .025
4	lb.	.0225	- .0235
7	lb.	.0265	- .0275
B.R.V.	lb.	.0325	- .04
Bunarex Resins	lb.	.0650	- .0750
Bunatak M	lb.	——	- .20
O	lb.	——	- .18
R	lb.	——	- .14
U	lb.	——	- .15
No. 21	lb.	——	- .08
No. 90	lb.	——	- .08
No. 865	lb.	——	- .17
No. 1080	lb.	——	- .09½
Burgundy Pitch	lb.	.1026	- .1050
Butac	lb.	.11	- .12
Butyl Benzyl Sebacate	lb.	.75	- .77½
Butyl Palmitate	lb.	——	- .26⅜
Butyl Roleate	lb.	.176	- .18
BWH-1	lb.	——	- .11
Campol (t.c.)	ton	——	- 42.00
Candelilla Wax, Prime	lb.	.78	- .85
Carbonex	lb.	.0325	- .0375
S Flakes	lb.	.0475	- .0525
S Plastic	lb.	.046	- .051
Carbowax 4000 (drums)	lb.	.29	- .30
Cardolite 615	lb.	.37	- .40
816	lb.	.25½	- .28½
5858	lb.	.42	- .46
Carnauba Wax, Crude	lb.	1.30	- 1.35
Refined	lb.	1.40	- 1.45
Substitute	lb.	.45	- 1.08
Yellow	lb.	1.75	- 1.80

PLASTICIZERS & SOFTENERS (Cont'd)

Celluflex 142 (and 179 (drums)	lb.	——	- .37½
Ceresine Wax	lb.	.15	- .20
Contogum	lb.	.06¾	- .10¼
Cumar Resins	lb.	.05½	- .14½
D.B.M.	lb.	——	- .30
Degras, Common	lb.	.10	- .14
Diamylphenol (l.c.l., dms.)	lb.	——	- .21
Dibenzyl Ether (drums)	lb.	——	- .40
Dibenzyl Sebacate	lb.	.66	- .70½
Dibutyl Phthalate	lb.	.36	- .385
Dibutyl Sebacate—Tech.	lb.	.75¼	- .77¾
C.P.	lb.	.77¾	- .80¼
Dicapryl Phthalate	lb.	——	- .45
Di-Carbitol Phthalate (dms.)	lb.	.39½	- .40
Dicyclohexyl Phthalate	lb.	——	- .43
Dielex	lb.	.0625	- .0650
Diethyl Phthalate (t.c.)	lb.	.31½	- .38½
Dihexyl Sebacate	lb.	.73¾	- .76¼
Dimethyl Phthalate	lb.	——	- .26
Dimethyl Sebacate	lb.	.77¾	- .80¼
Dinopol (dms.)	lb.	.46½	- .47
Dioctyl Phthalate (dms.)	lb.	.42½	- .43
Dipolymer Oil	gal.	.33	- .38
Dispersing Oil No. 10	lb.	.0525	- .055
Dutrex A (B, 5, 6)	lb.	.02½	- .03¾
15	gal.	.10	- .189
20, 21, 25	lb.	——	- .03
ELA (dlvd.)	lb.	——	- .80
Estac	lb.	——	- .16
Ethox (dms.)	lb.	.38½	- .39
Flexol DOP	lb.	——	- .433
TOF	lb.	——	- .47
3GH	lb.	——	- .56
3GO	lb.	——	- .53½
4GO	lb.	——	- .43
H-70	lb.	.56¾	- .64½
Hercolyn (dlvd.)	lb.	.15½	- .16
Herron-H.T.	gal.	.2400	- .2700
Herron-Plas	lb.	.0350	- .0375
Herron-Wax	lb.	.0500	- .0550
HT-300	lb.	.45¾	- .53
Indonex 632½ (633½, 634½, 638½)	gal.	.1200	- .1700
VG (dlvd.)	lb.	——	- .07
Indopol H-300 (bbls.)	gal.	1.28	- 1.32
JMH	lb.	——	- .65
Kapsol (dms.)	lb.	.44½	- .45
KP 23 (dms.)	lb.	.41½	- .42
70 (dms.)	lb.	.40½	- .41
120 (dms.)	lb.	.48½	- .49
140 (dms.)	lb.	.49½	- .50
150 (dms.)	lb.	.38½	- .39
Kronisol (drums)	lb.	.38½	- .39
Kronitex (drums)	lb.	.32½	- .37
Lanolin, Tech. Anhydrous	lb.	.20	- .26
Lead Oleate	lb.	.16½	- .42
Lindol (drums)	lb.	——	- .33½
2-Mercaptoethanol (drums)	lb.	——	- .75
Methox (dms.)	lb.	.35½	- .36
Methyl Oleate	lb.	——	- .20
Methyl Stearate	lb.	——	- .34
Monoplex DBS	lb.	.90	- .91
Monoplex DOS	lb.	.84	- .85
5 (dms.)	lb.	.98	- 1.00
11 (dms.)	lb.	.50	- .51
16 (dms.)	lb.	.45	- .46
Montan Substitute No. 506	lb.	.425	- .435
Montan Wax, Crude	lb.	.50	- .55
Monten Wax (c.l.)	lb.	.52	- .55
Monty Wax	lb.	——	- .35
Natac	lb.	.1050	- .1150
Neolene 210 (t.c.)	lb.	——	- .16
212 (t.c.)	lb.	——	- .14
220 (t.c.)	lb.	——	- .15
Nerium	lb.	——	- .09
Nevillac Resins (dms.)	lb.	.23	- .45
Neville Resins (dms.)	lb.	.09	- .14½
Nevindene Resins (dms.)	lb.	.11½	- .14½
Nevinol (dms.)	lb.	——	- .16
Nevoil	lb.	.03	- .04
Nevtex 10 (dms.)	lb.	——	- .08½
Nuba 1 (and 2) (dms.)	lb.	——	- .03½
3X (dms.)	lb.	——	- .05
15 (and 30) Oil (dms.)	lb.	——	- .17¼
781 Oil (dms.)	lb.	——	- .22
No. 480 Oil Proof Resin	lb.	——	- .17
Opalwax	lb.	——	- .45
Ortho-Nitrobiphenyl	lb.	.06	- .11
Ozokerite Wax No. 64 White	lb.	.31	- .32
Yellow	lb.	.25	- .26
P-1 (and 4, 6, 8, 20)	lb.	.26½	- .33
P-75	lb.	.66	- .72
Pale 4 (and 1000)	lb.	——	- .17¼
Palm Oil	lb.	——	- .11
Paradene Resins (dms.)	lb.	.05½	- .06½
Para Flux (dms.)	gal.	.18	- .19
2016 (l.c.l.)	gal.	.20	- .21
Para Lube (l.c.l.)	lb.	.046	- .048
Paraplex G-25	lb.	.90	- .91
G-40	lb.	.48¾	- .49¾
Parmo	lb.	.06	- .13½
Pentalene 90 (l.c.l., dms.)	lb.	——	- .17
92 (l.c.l., drums)	lb.	——	- .25

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INSOLUBLE SULPHUR

Stauffer CHEMICALS SINCE 1885

CRYSTEX (Insoluble Sulphur) preserves tack in uncured natural rubber and synthetic stocks. It does not bloom, and is especially useful in tire carcass stocks, and in camel back. Improved cures may be expected when CRYSTEX replaces ordinary sulphur in some compounds. CRYSTEX has been found useful in some cements, and in compounding latices for dipping baths. Due to improved and expanded manufacturing facilities, CRYSTEX now costs less and is more practical than ever in Rubbermakers' processes.

Commercial Rubbermakers' Sulphur, Tire Brand, 99.5% Pure — Refined Rubbermakers' Sulphur, Tube Brand, 100% Pure —"Conditioned" Rubbermakers' Sulphur — Carbon Tetrachloride — Carbon Bisulphide — Caustic Soda — Sulphur Chloride.

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PLASTICIZERS & SOFTENERS (Cont'd)

Pentaphen No. 114 (l.c.l., bags)	lb.	——	.23
Pepton 22	lb.	.70	.75
PG-16 (drums)	lb.	——	.34
Philplast No. 1	gal.	.18	.35
No. 2	gal.	.13	.35
Picco 10 (and 25)	lb.	——	.12
75 (and 100)	lb.	——	.11½
S.O.S.	gal.	.29	.34
Piccocizer 30	lb.	.05½	.06
Piccolastic A (and B, C, D, E)	lb.	.22	.22½
F	lb.	.139	.144
Piccolyte S Resins	lb.	.1500	.1575
Piccoumaron Resins	lb.	.06½	.14½
Piccovar	lb.	.12	.12½
Piccovol	lb.	.02½	.04
Pictar	gal.	.25	.30
Plas-Blend 360	lb.	.03¼	.04½
Plastac M	lb.	——	.09¾
Plasticizer No. 1889	lb.	——	.77
No. 2869 (l.c.l.)	gal.	——	.23
No. 2070 (l.c.l.)	gal.	——	.30
Plasticizer SC	lb.	.50	.52
Plasticizer VA-1	lb.	——	.40
Plastoflex 50	lb.	.36	.37
J-21	lb.	——	.41
Plastogen	lb.	.07¾	.08
Plastolein X-55 (dms.)	lb.	——	.60
X-148 (dms.)	lb.	——	.70
Plastone	lb.	.27	.30
Polymel D	lb.	——	.20
Polymel Liquid	gal.	.12	.17
Polymel Resins	lb.	.029	.05
PT 400 (600, 800) (c.l., dms.)	gal.	.34½	.45½
Refrigerator Oil 145-R	gal.	——	1.25
Reogen	lb.	.11½	.12
465 Resin (drums)	lb.	——	.04½
Resin 731	lb.	——	.13¾
Resin C	lb.	.02	.0275
Resinex	lb.	.02¾	.03¼
L-4	lb.	.01¾	.02½
Ridbo 369 (drums)	lb.	.08	.09
369-F (drums)	lb.	——	.12
Rosin Oil	gal.	.54	1.20
R.P.A. No. 2 (dlvd.)	lb.	——	.65
No. 3 (dlvd.)	lb.	——	.46
No. 5 (dlvd.)	lb.	——	.57
R.S.O. Softening Oil	lb.	.03	.05
Rubtar	gal.	——	.40
Santicizer B-16	lb.	.50	.57
E-15	lb.	.47	.54
M-17	lb.	.44	.51
No. 140	lb.	.31	.38
Softener No. 20	gal.	.09	.25
S.P.C.	lb.	——	.19½
Stanolind Petrolatum	lb.	.037	.081
Wax	lb.	.25	.30
Staybelite Resin (dms.)	lb.	——	.11
Sunny South Burgundy Pitch	cwt.	10.51	10.75
Sunny South Pine Tar	gal.	.34½	.45½
Sunny South Rosin Oil	gal.	.50	.67¾
Superla Wax	lb.	.25	.30
Syncera Wax	lb.	.175	.225
Synplasticizer	lb.	——	.10
Syn Tac (c.l.)	gal.	——	.33
Synthol	lb.	——	.2550
Tar, Refined	gal.	.12	.17
K-Tarnel NR (t.c.)	lb.	——	.0851
Terpene A	gal.	——	.65
TP-90B (and TP-95)	lb.	.55	.65
TP98	lb.	——	.50
Triacetin	lb.	.34	.45
Tricresyl Phosphate	lb.	.31	.38
Turgum S	lb.	.09½	.10½
Vanadiset B, C, D	lb.	.021	.055
Pulverized	lb.	.08½	.31
Solution	gal.	.40	.65
Vistac No. 1	gal.	——	1.32
No. 2	gal.	——	1.66
No. 4	gal.	——	1.80
Witresin—Granular	ton	41.00	43.00
Solid	ton	36.00	38.00

PROCESSING AIDS

Castor Oil, Processed (dms.)	lb.	——	.17¼
Refined (drums)	lb.	——	.15¾
Castorwax (min. 400 lbs.)	lb.	——	.25
Dutrex 7	lb.	.02½	.03¼
30	gal.	.24	.27
ELA (dlvd.)	lb.	——	.80
Heron S.P.O.	lb.	.22	.23
Resin No. 510	lb.	——	.19
Zeton (dms.)	lb.	——	.32

PROTECTIVE & STABILIZING AGENTS

Acacia	lb.	.12¾	.21
Agchem SA-9 (to SA-12)	lb.	.65	1.02
Alpha Protein	lb.	.28	.32
Arcostocrat	lb.	——	.07½
Carob Bean Flour	lb.	.42	.50
Casein	lb.	.33	.40
Ethylene Diamine 68%	lb.	.57	.58
Karaya Gum	lb.	.20	.50
Prosein	lb.	.071	.09
Rex Compound No. 2801	lb.	——	.15
Sodium Alginate	lb.	——	1.50

PROTECTIVE AGENTS (Cont'd)

Stablex B	lb.	——	.95
Tragacanth Flakes	lb.	.60	1.35

RECLAIMING AGENTS

1-D Heavy Oil (drums)	lb.	.04	.05
No. 517 H.B. Oil	gal.	.11½	.16¼
535	gal.	.22	.27
No. 523 H.S. Oil	gal.	.22	.27
C-6 Oil (and 28, 32)	gal.	.33	.38
C-10 Oil	gal.	.25	.30
C-33 Oil	gal.	.20	.25
Caustic Soda—Flake 76% (c.l., drums)	cwt.	——	3.25
Liquid 50% (t.c.)	cwt.	——	2.25
Solid 76% (c.l., dms.)	cwt.	2.50	2.85
Cresylic Acid (99-100%)	gal.	1.20	1.29
D-4	gal.	.19	.24
E-5	gal.	.17	.22
Heavy Aromatic Naphtha (t.c.)	gal.	——	8.25
LX-83 Reclaiming Solvent	gal.	.13	.24
LX-572 Reclaiming Oil	gal.	.17	.28
PT 67	gal.	.60	.70
PT 101	gal.	.34½	.45½
PT 150 Solventene	gal.	.44	.45
Q Oil	gal.	.206	.256
Reclaiming Oil 1621	lb.	.025	.035
Reclaiming Reagent No. 3	lb.	.12	.15
Reclaiming Resin No. 1	gal.	.15	.35
R.P.A. No. 3 (dlvd.)	lb.	——	.46
Soda Ash (c.l., bags)	cwt.	——	1.20
Solvent 534	gal.	.22	.27
Solvent Oil 21	gal.	.24	.29
C-42	gal.	.30	.35
X-1 Resinous Oil	lb.	.0135	.02
X-60 Solvent	gal.	.22	.30

REINFORCING AGENTS—CARBON BLACK

Channel, Hard Processing (HPC) (bags)

Atlantic HPC-98	lb.	.0732	.1175
Continental F	lb.	.0732	.1125
Croflex	lb.	.0732	.1175
Crow	lb.	.0732	.1175
Dixiedensed (and S)	lb.	.0732	.1175
Huber HX	lb.	.0732	.1150
Kosmobile (and S)	lb.	.0732	.1175
Kosmos T	lb.	.0732	.1175
Micronex HPC	lb.	.0732	.1125
Spheron 4	lb.	.0732	.1170
Witco Disperso No. 6	lb.	.0732	.1125

Channel, Medium Processing (MPC) (bags)

Atlantic MPC-95	lb.	.0732	.1175
Continental A	lb.	.0732	.1125
Croflex TH	lb.	.0732	.1175
Dixie R-1	lb.	.0732	.1175
Dixiedensed HM (and S-66)	lb.	.0732	.1175
Huber TX	lb.	.0732	.1150
Kosmobile HM (and S-66, SMG)	lb.	.0732	.1175
Kosmos M	lb.	.0732	.1175
Micronex Standard	lb.	.0732	.1125
Spheron 6	lb.	.0732	.1170
Witco Disperso No. 1	lb.	.0732	.1125

Channel, Easy Processing (EPC) (bags)

Atlantic EPC E-42	lb.	.0732	.1175
Continental AA	lb.	.0732	.1125
Croflex 77	lb.	.0732	.1175
Dixiedensed 77	lb.	.0732	.1175
Kosmobile 77	lb.	.0732	.1175
Micronex W-6	lb.	.0732	.1125
Spheron 9	lb.	.0732	.1170
Witco Disperso No. 12	lb.	.0732	.1125
Wyex	lb.	.0732	.1150

Channel, Conductive (CC) (bags)

Dixie 5	lb.	.0740	.1175
Kosmink	lb.	.0740	.1175
Spheron C	lb.	.1200	.1600
I	lb.	.1000	.1400
N	lb.	.2200	.2500
Voltex	lb.	.1500	.1850

Furnace, Fast Extruding (FEF) (bags)

Statex M	lb.	.0550	.0950

Furnace, High Modulus (HMF) (bags)

Continex HMF	lb.	.0500	.0900
Dixie 40	lb.	.0500	.0900
Kosmos 40	lb.	.0500	.0900
Modulex	lb.	.0500	.0900
Philblack A	lb.	.0550	.0950
Statex 93	lb.	.0500	.0900
Sterling L	lb.	.0500	.0900
SO	lb.	.0550	.0950

Furnace, Reinforcing (RF) (bags)

Kosmos 60	lb.	.0732	.1150

Furnace, Semi-Reinforcing (SRF) (bags)

Continex SRF	lb.	.0350	.0750
Dixie 20	lb.	.0350	.0750

Furnace, Semi-Reinforcing (Cont'd)

Essex	lb.	.0350	.0750
Furnex	lb.	.0350	.0750
Gastex	lb.	.0350	.0750
Kosmos 20	lb.	.0350	.0750
Pelletex	lb.	.0350	.0750
Seminex	lb.	.0350	.0750
Sterling NS	lb.	.0350	.0750
R	lb.	.0350	.0750
S	lb.	.0350	.0750

Furnace, Fine (FF) (bags)

Statex B	lb.	.0575	.0975
Sterling 99	lb.	.0650	.1050
105	lb.	.0732	.1170
Vulcan	lb.	.0732	.1170

Furnace, High Abrasion (HAF) (bags)

Philblack O	lb.	.0732	.1132

Furnace, Very Fine (VFF) (bags)

Statex K	lb.	.0732	.1125

Thermal, Fine (FT) bags)

P-33	lb.	——	.0500

Thermal, Medium (MT) (bags)

Thermax (c.l.)	lb.	——	.0300

REINFORCING AGENTS—MISCELLANEOUS

Darex Copolymer No. 3	lb.	.39½	.42
No. X34	lb.	.39½	.42
Darex Copolymer Latex No. 3 (and X34)	lb.	.36½	.50
Durez 12687 (and 12707)	lb.	——	.32
Durez 13355	lb.	——	.26
Marbon B	lb.	.65	.75
S and S-1	lb.	.36	.43
Marmix	lb.	.36	.43
Pliolite S6 Resin	lb.	.36	.37
G Masterbatch	lb.	.35	.36
G50 Masterbatch	lb.	.35	.36
R Masterbatch	lb.	.38	.39

RETARDERS

ESEN	lb.	.34	.39
Retardex	lb.	——	.51

RUBBER SUBSTITUTES

Mineral Rubber

38	ton	26.00	32.50
Black Diamond	ton	26.00	27.50
Byerlyte	ton	42.50	57.50
Gilsonite, Selects (c.l.)	ton	33.50	34.50
Hard Hydrocarbon (dms.)	ton	40.00	42.00
Herron Flake	ton	48.50	49.50
Mineral Rubber, solid	ton	41.60	43.00
Parmr (drums)	ton	26.00	30.00
Pioneer	ton	33.00	60.00

Vulcanized Vegetable Oils (Factice)

Amberex	lb.	.27	.38
Brown	lb.	.18	.38
Dispersed	lb.	.28	.49
Neophax	lb.	.20	.38
White	lb.	.13	.39

Miscellaneous Rubber Substitutes

Gilsowax	lb.	.04½	.05
Insulac	lb.	.06	.06½
Resin No. 1098 (drums)	lb.	——	.65
No. 1198	lb.	.31	.35

SOLVENTS

Acetone (dlvd.)	lb.	.08½	.10½
American Dipentene	gal.	.38	.39
Amsco Lactol Spirits (t.c.)	gal.	——	.14
Rubber Solvent (t.c.)	gal.	——	.13½
Solv A (t.c.)	gal.	——	.18½
Solv B (t.c.)	gal.	——	.22½
Special Napthalite (t.c.)	gal.	——	.13½
Textile Spirits (t.c.)	gal.	——	.14
Amyl Chlorides, Mixed (l.c.l.) (drums)	lb.	——	.08
Benzol 90%	gal.	.17	.24
Butyl Acetate (t.c.)	lb.	——	.305
Butyl Alcohol (t.c.)	lb.	——	.305
Secondary (dlvd.)	lb.	.10½	.12½
Tertiary (dlvd.)	lb.	.12	.14
Carbon Bisulfide, Tech	lb.	.05	.08
Carbon Tetrachloride	gal.	——	.80
Cosol 1	gal.	.26	.34
Cosol 2	gal.	.25	.33
Cyclohexane	lb.	.08	.10
Cyclohexanone	lb.	.25	.27
Diacetone, Pure (dlvd.)	lb.	.12	.14
Dichlorethyl Ether (dms.)	lb.	.16	.17
Formal (dms.)	lb.	.26	.27

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Sun CHEMICAL CORPORATION

SOLVENTS (Cont'd)

Dichloropentane (l.c.l.)	lb.	—	.04½
-Dipentene 122 (dms.)	gal.	—	.51
Ethyl Alcohol (t.c.)	gal.	—	.96
Ethylene Dichloride (drums, dlvd.)	lb.	.08	.09½
Halowax Oil	lb.	.27	.30
Heptanes (t.c.)	gal.	—	.15
Hexalin Cyclohexanol	lb.	.20	.22 a
Hexanes (t.c.)	gal.	—	.15¾
Isopropyl Alcohol, Ref. 99% (dlvd.)	gal.	.45	.57½
Ether, Ref. (dlvd.)	lb.	.04½	.06½
Mesityl Oxide (dlvd.)	lb.	.11½	.14
Methanol (dms., dlvd.)	gal.	.41	.56½
Methyl Acetone, Syn. (drums, dlvd.)	gal.	.46	.52
Methyl n-Amyl Ketone (drums)	lb.	.37	.39
Methyl Ethyl Ketone	lb.	.10	.12½
Methyl Isobutyl Ketone (dlvd.)	lb.	.12½	.15½
N-5 Pentane Mix. (t.c.)	gal.	—	.06½
N-6 Hexanes (t.c.)	gal.	—	.11¼
N-7 Heptanes (t.c.)	gal.	—	.10½
Petrolene (t.c.)	gal.	—	.10⅝
Picolines, Alpha, Refined	lb.	.30	.34
Mixed	lb.	—	.30
Pyridine, Refined	lb.	.65	.69
Quinoline	lb.	.43	.52
Rubber Solvent (t.c.)	gal.	—	.12½
Rubsol (t.c.)	gal.	—	.08625
Skellysolve B (Hexanes) (t.c.)	gal.	—	.141
C (Heptanes) (t.c.)	gal.	—	.133
E (Octanes) (t.c.)	gal.	—	.155
R (Solvent Naphtha)	gal.	—	.109
Solvenol	gal.	—	.51
Solvent, Crude, Light	gal.	.19	.28
Solvesso 100 (t.c.)	gal.	—	.2812
150 (t.c.)	gal.	—	.2812
Sunny South Dipentene	gal.	.38	.39
Toluene (drums)	gal.	—	.28
Toluol (t.c.)	gal.	—	.23
Trichlorethane	lb.	.11	.12
Triglycol Dichloride (dms.)	lb.	—	.49
Tromex	lb.	.078	.083
X-7 Sp. Heptanes (t.c.)	gal.	—	.10
X-8-A Solvent Naphtha	gal.	—	.07¾
Xylene (drums)	gal.	—	.28

STABILIZING AGENTS (for Vinyl Resins)

Dutch Boy DS-207	lb.	—	.48
Plumb-O-Sil A	lb.	—	.26
Tribase	lb.	—	.22¼
Eagle Basic Silicate White Lead	lb.	.18½	.19¾
Lead Stearate, Precip.	lb.	.55	.57
Fused	lb.	.60	.62
Stabelan A	lb.	.55	.65
Stabilizer No. 1	lb.	1.55	2.05
Stabilizer No. 32	lb.	.75	1.15
Stabilizer V-7939	lb.	—	.60
Stabilizer JCX	lb.	—	.45
SN	lb.	.36	.42
V-1-N	lb.	.44	.50
V-9	lb.	—	.85
Vanstay	lb.	.33	.35

SUN CHECKING AGENTS

Antisol	lb.	.25	.26
Heliozone (dlvd.)	lb.	.25	.26
Sunproof	lb.	.25	.30
Jr.	lb.	.18	.23
Tonox	lb.	.50	.59

TACKIFIERS

Advaresin 100	lb.	.13½	.14
Agchem RC 30	gal.	.65	1.34
Amberol ST-137X	lb.	.33	.33½
Beckopol 1400 (dlvd.)	lb.	.25	.25½
Dutrex 44	gal.	—	.919
E-310 Resin Emulsion	lb.	—	.14
Galex (drums)	lb.	.1325	.1725
Koresin	lb.	.46	.58
Lindol Emulsion (drums)	lb.	—	.38
Liquid Rubber Flux	lb.	—	.125
Pentacizer 344	lb.	—	.20
Pentalyn Resins (dlvd.)	lb.	.19½	.22½
Resin V	lb.	—	.23¾
Rubtack	lb.	—	.12
Staybelite Esters (dlvd.)	lb.	.19½	.22½
Super-Beckacite No. 1001 (dlvd.)	lb.	.42	.42½

THICKENERS (FOR LATEX)

Acrysol GS	lb.	.14½	.22
Betanol (drums)	lb.	—	.70
Emulsorex No. 5	lb.	—	.35
Propylene Laurate (dms.)	lb.	—	.36
Sodium Silicate	lb.	.01	.02

VULCANIZING AGENTS

Selenium

Vandex	lb.	—	2.00

Sulfur

Crystex (l.c.l.)	lb.	.19½	.23
Dispersed Sulfur	lb.	—	.09
No. 2	lb.	.10	.15
Devil (c.l.)	cwt.	—	1.35
Insoluble Sulfur 60	lb.	—	.16
Star (c.l.)	cwt.	—	1.85
Tire	cwt.	1.50	2.00
Tube (c.l., dlvd.)	cwt.	2.00	2.60

Tellurium

Latex Telloy	lb.	—	2.00
Telloy	lb.	—	2.00

Miscellaneous Vulcanizing Agents

VA-3	lb.	.55	.65
Vultac No. 1	lb.	.38	.45
No. 2	lb.	.38	.45
No. 3	lb.	.42	.49

WASHING & FINISHING AGENTS

Apcolene (t.c.)	gal.	—	.09½

WETTING AGENTS

Advawet No. 15	lb.	—	.18
No. 33	lb.	.40	.43
Aerosol OT 70% Clear	lb.	.80	1.00
Agchem SA-15 (16, 18)	lb.	.17	.29
Alrosol (dms.)	gal.	—	.48
Aquarex ME (dlvd.)	lb.	—	.92
NNS (dlvd.)	lb.	—	.60
NS (dlvd.)	lb.	—	.75
Areskap 50	lb.	.30	.38
Dry 100	lb.	.60	.72
Aresket 240	lb.	.30	.38
Dry 300	lb.	.60	.72
Aresklene 375	lb.	.42	.57
Dry 400	lb.	.70	.84
Lecithin	lb.	—	.22
Santomerse D	lb.	.43	.65
S	lb.	.13	.25
Sorbit P	lb.	—	.28
Stablex G	lb.	—	.70
Triton K-60	lb.	.33½	.41
N-100	lb.	.59½	.67
R-100	lb.	.14½	.25
720	lb.	.30½	.38
770	lb.	.21¾	.29¼
Vultamol	lb.	—	.17½

MISCELLANEOUS CHEMICALS

Acto 450 (550-W, 600, 630)	lb.	.109	.145
Agchem SA-17	lb.	—	.29
Aquarex SMO (dlvd.)	lb.	—	.50
A.S.T.M. Oil No. 1 (and No. 3)	gal.	1.00	1.15
Black Shield 4701	lb.	—	.21
Copper Inhibitor X-872-L	lb.	—	1.75
2-Ethylhexanol (dms., dlvd.)	lb.	.25	.26
Glycerine, 88% Sap., Crude (dlvd.)	lb.	.35½	.36
MODX (tons)	lb.	—	.29½
Para Resin No. 1784	lb.	—	.09¾
No. 2457 (c.l.)	lb.	—	.04
No. 2718 (c.l.)	lb.	—	.04
pHR	lb.	—	2.00
Pigmented Filmite	lb.	—	.16½
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SR-10	gal.	.60	.75
Resin No. 1226	lb.	.31½	.36½
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Santocel	lb.	—	.50
Sublac	lb.	.31	.34
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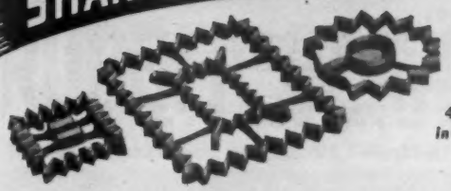

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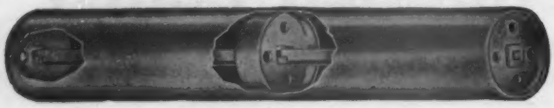

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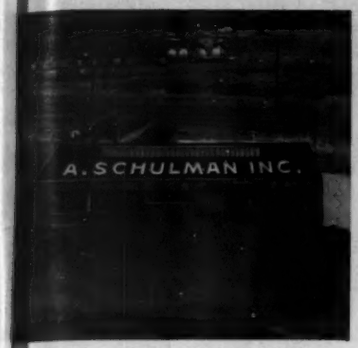

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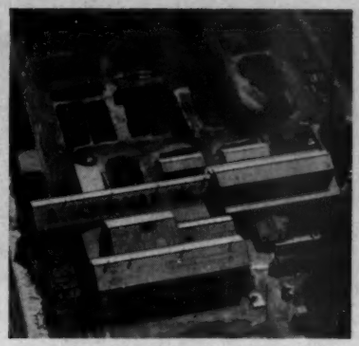

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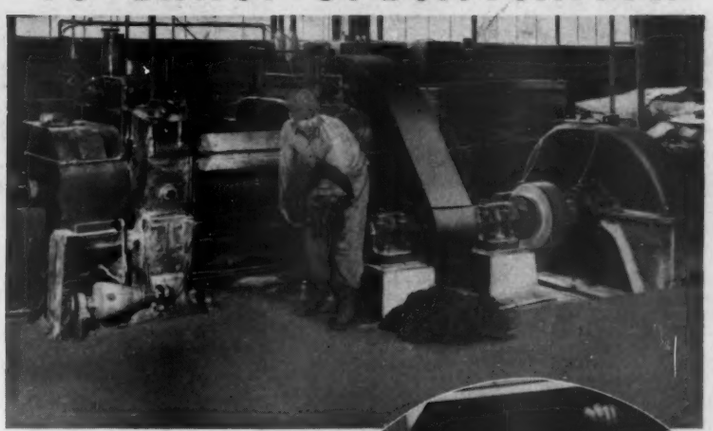

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